FINAL
ADDENDUM 1 WORK PLAN FOR THE KERR-McGEE CHEMICAL CORPORATION SUPERFUND SITE TRONOX FACILITY SODA SPRINGS, IDAHO

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1.0 INTRODUCTION

1.1 General

The following work plan describes the tasks that will be completed for the Kerr-McGee Chemical Corporation Soda Springs, Idaho Superfund Site. This work plan is intended to address the follow up actions identified by the United States Environmental Protection Agency (US EPA) Region 10 before a protectiveness statement can be made for the site remedy. These follow up actions were identified in the second 5-year review that was conducted by the US Army Corps of Engineers for USEPA Region 10 in June and July 2007. The findings of the second 5-year review are discussed in the Second Five-Year Review Report for Kerr-McGee Chemical Corp. (Soda Springs) Superfund Site (US EPA, September 2007).

The follow up actions resulting from the site review are contained in the Addendum 1 to the statement of work (SOW). This work plan is the result of negotiations between Tronox (current site owner at the Kerr-McGee Superfund Site) and US EPA Region 10. The follow up actions identified in this document include:

- Evaluate the Current Remedy;
- Evaluate the Current Ground Water Monitoring Network, and;
- Reduce the Detection and Reporting Limits for Arsenic in Water Samples.

The reduction of the detection limits for arsenic has been completed. This action was completed in October 2007 through a change in the analytical method. This new method will be used for all future analytical work. A letter report documenting the change and a comparison with previous results was transmitted to EPA on March 26, 2008. Results of this analysis indicated that the EPA Method 6020 ICP-MS arsenic analytical method did not result in a substantially different outcome with respect to the MCL when compared with previous testing results.

1.2 Purpose of the Work Plan

The purpose of this work plan is to:

- Evaluate whether the current level of contaminants of concern (COC) in the ground water can achieve the specified clean up levels identified in the Record of Decision within a specifiable timeframe;
- Assess whether the selected remedy that has been implemented at the site has addressed the sources contributing to ground water COC;
- Assess the current ground water monitoring network and evaluate whether the network is adequate in evaluating contributions from site sources, ground water clean up performance and off-site migration of COC in ground water, and;
- Identify data gaps from the RI/FS, RD/RA and semi-annual monitoring.

Data gaps identified through the proposed work contained in this plan will be included in the draft remedy evaluation report. The draft remedy evaluation report will also include recommendations for further actions to address data gaps or deficiencies. This work plan describes the approaches, methodologies, information sources and other pertinent data that will be investigated to address the remedy evaluation. The work plan is parsed into the following sections:

- The Introduction contained in this section (Section 1) provides background information for the site and background details for the ground water aquifer;
- Section 2 of this work plan describes the data quality objectives developed for the work to be completed for the draft remedy evaluation report;
- Section 3 of this work plan describes the work that will be completed to evaluate the current remedy implemented in 1997 and for the calcine cap in 2001;
- Section 4 describes the work that will be done to evaluate the current ground water monitoring network;
- Section 5 presents the analytical methods, detection limits and reporting limits for the arsenic ground and surface water analysis that is currently implemented, and;
- Section 6 presents the schedule to complete the work presented in the work plan.

1.3 Background Information

1.3.1 Site Location

The Tronox site (formerly known as the Kerr-McGee Chemical Corporation site) is located in Caribou County, Idaho approximately 1.5 miles north of Soda Springs as shown in Figure 1-1. The Tronox site is on the east side of State Highway 34. The site is bordered by agricultural land on three sides (north, east and south) and by the Monsanto Chemical Company elemental phosphorus plant on the west (on the west side of the highway) as shown on Figure 1-2.

Figure 1-3 shows the location of the monitor wells sited near source areas investigated as part of the remedial investigation (RI). The location of the landfill that was constructed as part of the remedial actions and the lined solvent extraction ponds are also shown on Figure 1-3. Currently, the double lined 10-acre pond is the only remaining pond at the site.

1.3.2 Site History

Construction of the vanadium production plant facility was completed in the summer of 1963 and full operation began in March 1964. Operation of the vanadium plant continued until January 1999 when the plant was shut down. A number of waste impoundments generated during vanadium plant production are shown on Figure 1-4. The vanadium plant facility was demolished in 2002 and the site surface was covered and graded with limestone fines.

The site was placed on the National Priorities List on October 4, 1989. The effective date of the consent order to conduct a remedial investigation and feasibility study (RI/FS) was October 4, 1990. The remedial investigation required by this consent order was completed in 1995. The Record of Decision was signed in September 1995 and amended in 2000. The feasibility study (FS) for the entire site was completed in 1996 and a supplemental feasibility study for the calcine capping was completed in 2000. The remedial actions were completed between 1997 and 2001.

In 1997 and 1998, Kerr-McGee constructed a fertilizer production plant facility that was intended to process the calcine produced by the vanadium plant and process material from the calcine impoundment on the east side of the plant facility. The plant operated intermittently until July 2000 when the plant ceased operation after it was determined by EPA that Kerr-McGee would be unable to reduce the calcine impoundment within a specified timeframe of 8 years. The calcine was capped in August 2001 and the fertilizer plant was demolished in 2002 and 2003.

The Tronox facility currently produces lithium-manganese oxide. Production of this material began in 1999. This material is used to produce rechargeable batteries. There are no liquid discharges from the current operations.

1.3.3 Summary of Past Ground Water Investigations

1.3.3.1 Site Hydrogeology

Remedial investigations completed between 1991 and 1994 indicated that ground water beneath and downgradient from the Tronox site exists within the basalt sequences, the basalt interflow zones, and within limited areas of the alluvium. Ground water also exists within the Tertiary Salt Lake Formation that underlies the basalt. Although ground water occurs in the Salt Lake Formation and within a limited area of the alluvium on-site, the basalts are considered the principal aquifer beneath the Tronox site.

The hydrogeologic properties of the basalts and interflow zones were characterized for the Tronox RI/FS, using:

- Geologic, geophysical, hydraulic head, hydraulic gradient, and hydraulic conductivity parameters from the installed wells;

- Hydraulic response data observed in the monitor wells, and;
- Observation and testing data from 14 on-site monitor wells, 4 off-site monitor wells and 5 on-site coreholes.

Table 1-1 was taken from the RI (Dames & Moore, 1995). This table shows that the Salt Lake Formation has a hydraulic conductivity that is one to three orders of magnitude smaller than the hydraulic conductivity of the basalt aquifer. The basalt aquifer is the principle site aquifer that that lies unconformably above the Salt Lake Formation. Table 1-2 lists the results of hydraulic conductivity testing of the current monitoring well system in decreasing order, and identifies the locations, elevations and the completed depths and screened intervals for these wells.

The Salt Lake Formation

The Tertiary Salt Lake Formation is comprised of tuffaceous sandstones, conglomerates and limestones that yield small amounts of ground water for domestic and stock purposes, and are unpredictable as a water-supply source. The Salt Lake Formation is not considered part of the shallow ground water system. The Salt Lake Formation was cored on-site in corehole CH-3 from 231 to 250 feet (total depth of corehole CH-3) and was found to consist of fractured quartzite, sandstone, and clay with a packer test hydraulic conductivity of 0.77 ft/day. This is within, but at the low end of the range of packer-test hydraulic conductivities estimated for the deeper part of the overlying basalt sequence. No wells at the Tronox site were completed within the Salt Lake formation because the hydraulic conductivity of the formation is small, and the ground water quality monitored at the most downgradient location on the site in the deepest portion of the basalt aquifer (well KM-19) meets the risk-based concentration (RBC) for the site COC. Therefore, the vertical extent of the ground water quality impacted by site COC was defined in the RI to be within the overlying basalt aquifer.

Alluvium

Seismic refraction studies performed as part of the RI indicated that alluvium is thickest and extends to the greatest depth on the eastern side of the plant facility. Based on geologic data from well KM-2, an area of saturated alluvium overlies the basalt in the eastern part of the Tronox facility at well KM-2 where the elevation of the basalt/alluvium contact falls below the elevation of the water table. The area of saturated alluvium appears to be limited near the east side of the facility, extending a short distance to the north and south of the capped calcine tailings. The alluvium has not been noted to contain ground water at other locations on the Tronox site.

Basalt Aquifer

The basalts and interflow zones of the mid-Pleistocene Blackfoot Lava Field comprise the principal aquifer beneath the Tronox site. All on-site Tronox monitor wells, with the exception of monitor well KM-2, are screened exclusively within these basalts and interflow zones as shown in Tables 1-1 and 1-2. The Monsanto production wells are screened within the basalt aquifer to the top of the Tertiary Salt Lake formation.

The basalt sequence at the Tronox site, described in the Final Remedial Investigation Report (Dames and Moore, 1995) is comprised of five identifiable basalt flows (Basalts Nos. Qb_1 through Qb_5) and associated interflow zones (Interflow Zones Nos. I_1 through I_4). Two younger basalts (Qb_{5a} and Qb_{5b}) and associated interflows were identified to the south and west of the site and are believed to have occurred as post-faulting flows. These basalts and interflow zones are believed to be stratigraphically similar to basalt flows identified at the Monsanto Site by Golder (1985 and 1992a).

However, the hydrogeologic characteristics of the basalt flows between the two sites appear to be different. Magnitudes of hydraulic conductivities of the basalt flows and interflow zones at the Tronox site are relatively similar as shown in Tables 1-1 and 1-2, whereas basalts and interflow units at the Monsanto site are indicated to differ substantially. Testing during the RI indicated magnitude of hydraulic conductivities observed at the KMCC site (0.01 to 340 ft/day) is less than the magnitude range reported for the Monsanto site for basalts and interflow zones (1 to 10,000 ft/day). Local water level elevation and water quality differences exist between adjacent shallow, intermediate-depth and deep wells at Monsanto. Water quality and aquifer test data for Tronox indicate that the entire thickness of saturated basalt is in relatively good vertical hydraulic connection over the area of the Tronox site.

Faults are considered to represent zones of increased transmissivity at the Tronox site. The fractured bedrock and interconnected nature of the fractures within the basalt aquifer beneath the Tronox site allow for notable mixing of site COC within the shallow and intermediate depths of the aquifer. This is particularly notable at nested sites KM-15 and KM-18 to the west (downgradient) of the Finch Spring Fault. Ground water flow directions from the Tronox site are normal to (across) structural geologic features such as mapped fractures and the Finch Spring Fault. Faults were interpreted to be barriers to flow at the Monsanto site. Based on interpreted ground water contours for the Monsanto site, direction of ground water flow is interpreted to be in the same approximate bearing as the trend mapped faulted features to the south of the Monsanto production wells. Therefore, faults at the Monsanto represent more of an obstacle to flow by offsetting more permeable against less permeable zones in the aquifer.

1.3.3.2 Hydraulic Conductivities of the Basalt Aquifer

Primary permeability of unbroken basalt is small. Most ground water in basalt is transmitted along secondary features such as joints or fractures. Vertical columnar joints are a common feature observed in basalt exposed to the south and southwest of the site along the trace of the Finch Spring Fault. The presence of intensely fractured or vesicular zones, rubble zones, and/or cinder zones can also greatly increase the ability of basalt to transmit water. Interflow zones are comprised of subaerial deposited materials, including clays, cinderaceous deposits, alluvial sands and gravels, organic debris and weathered and broken basalt. Variations in the ability of interflow zones to transmit water result from changes in the character and thickness of these materials.

Observed hydraulic conductivities estimated from the slug, specific capacity, and pumping tests conducted in the shallow, intermediate-depth, and deep wells shown in Tables 1-1 and 1-2 include the following:

- Basalts ranged from 8 to 340 ft/day;
- Interflow zones ranged from 90 to more than 200 ft/day.
- Basalts and interflow zones together ranged from 2 to more than 100 ft/day.
- Basalt No. Qb_5 (shallow basalt represented by shallow well screened zones including KM-2, KM-5, KM-6, KM-7, KM-8, KM-9, KM-13, KM-15 and KM-16) ranged from about 9 to 340 ft/day.
- Basalt No. Qb_3 (Deeper basalt screened in wells KM-10, KM-11, KM-12, and KM-18) ranged from 8 to almost 100 ft/day.
- Hydraulic conductivities estimated for monitor well KM-19 screened in Basalt No. Qb_2 and Interflow Zone No. I_1 ranged from about 15 to almost 70 ft/day.

Distribution of the hydraulic conductivity across the site is shown on Figure 1-5. Generalizations about hydraulic conductivities observed within the basalt aquifer at the Tronox site shown in Tables 1-1 and 1-2 include the following (Dames & Moore, 1995):

- The hydraulic conductivities of interflow zones are not significantly greater than those of the basalt flows;
- Hydraulic conductivities of the shallower basalts (Basalt No. Qb_5) are generally greater but not significantly greater than those of the deeper basalts (Basalt No. Qb_3);
- A horizontal layer of significantly smaller hydraulic conductivity which could greatly limit or prevent vertical movement of ground water was not identified;
- A continuous horizontal layer of significantly larger hydraulic conductivity along which horizontal ground water flow could be localized was not identified;

- Hydraulic conductivities in the shallow wells on the east side of the plant (KM-1, KM-2, KM-3, and KM-4) range from 90 to 270 ft/day and appear to be greater than hydraulic conductivities in shallow wells on the west side of the plant (KM-5, KM-8, KM-9, and KM-13), which range from 9 to 48 ft/day.

1.3.3.3 Estimated Ground Water Velocities

Horizontal hydraulic gradients within the shallower basalt aquifer vary from 0.01 feet per foot in the eastern part of the site to 0.03 feet per foot in the western part of the site. Effective porosities have been reported for the basalts of the Snake River Plain aquifer of southeastern Idaho to range from about 8 to 10 percent (Robertson, 1974; Lewis and Goldstein, 1982; Isherwood, 1981; Nace et al., 1959). Using an effective porosity of 8 percent, a gradient of 0.01 ft/ft and range of hydraulic conductivities of 5 to 270 ft/day (see the range of hydraulic conductivities shown in Table 1-2), then a range of estimated ground water particle velocities of 0.6 to 34 ft/day can be calculated for the eastern part of the plant site. Using a gradient of 0.03 ft/ft, an effective porosity of 8 percent and the observed range of hydraulic conductivities of 9 to 340 ft/day on the western portion of the site (see the range of hydraulic conductivities shown in Table 1-2), then a range of ground water particle velocities of 3 to 130 ft/day can be estimated.

1.3.3.4 Current Direction and Rate of Ground Water Flow

Ground water flows in response to hydraulic gradients from areas of higher hydraulic head to areas of lower hydraulic head at rates that are proportional to hydraulic conductivity and hydraulic gradient and inversely proportional to effective porosity of the aquifer. Ground water can flow vertically through aquifers or between aquifers in response to vertical hydraulic gradients and horizontally within aquifers in response to horizontal gradients. Ground water in the Shallow Aquifer System generally flows southward from the topographically higher Blackfoot Reservoir (about 12 miles north of the Tronox facility) to seeps and springs along the topographically lower Bear River.

Horizontal hydraulic gradients and ground water flow directions within the shallow basalt units at the site are indicated by water level elevations measured during May 2007 and are contoured on Figure 1-6. Site gradient averaged about 0.02 ft/ft in 2007.

The predominant flow direction beneath the plant site is to the west-southwest, as shown on Figure 1-6. The western ground water flow direction beneath the site is caused by pumping from the Monsanto production wells located west of the Tronox site. Ground water levels beneath the east side of the facility suggest a more southerly flow component, with flow beneath the east side of the facility directed towards well KM-3. This subtle change in flow direction may be the result of capping the calcine in 2001. Previous annual evaluations indicated a possibly flatter and more westerly overall flow pattern for this area.

1.4 Summary of Record of Decision

The original Record of Decision (ROD) for the Kerr-McGee Chemical Superfund site was signed September 28, 1995. The remedial actions required by this document included:

- Elimination of uncontrolled liquid discharges from the facility to soil, surface or ground water;
- Excavation and reuse/recycling of buried calcine tailings within an 8-year period;
- Excavation and on-site disposal of S-X and scrubber pond solids in a lined and covered on-site landfill cell;
- Semi-annual ground water monitoring to determine the effectiveness of source control measures and a comprehensive evaluation of ground and surface water monitoring data;
- Establishment of Institutional Controls to curb ground water use for as long as the ground water exceeds the performance standards;
- Resource recovery/reuse of the roaster reject in the vanadium production facility, and;

- Excavation and on-site disposal of the windblown calcine.

Reviews will be conducted by EPA every five years until performance standards have been met for all COC identified in the ROD. These five-year reviews will be conducted to meet the requirements of CERCLA, the National Contingency Plan and Agency Policy and Guidance per the "Comprehensive Five-Year Review Guidance", EPA-540-R-01-007, June 2001.

In 2000 the ROD for the facility was amended. This amendment was signed on July 13, 2000. The ROD amendment called for capping the calcine tailing on the east side of the industrial facility in place. The roaster reject and off-spec fertilizer from the fertilizer plant was to be included in the material placed under the cap. The roaster reject was included because the vanadium plant was not operating. The off-spec fertilizer was included because there was no market for the material and additional material was needed to fill the area. All other requirements of the September 1995 ROD remained in effect.

1.5 Summary of Remedial Actions Completed

A complete discussion of the remedial action completion activities is described in the Draft Remedial Action Completion Report Revision I (GET, 1999), and the Draft Remedial Action Completion Report for Calcine Capping, 2000 through 2001 (GET, 2003). Remedial Actions for the Tronox vanadium facility addressed the selected site remedy from the Record of Decision (ROD, September 1995) and subsequent amendment to the ROD (July 2000). The Remedial Action for the site included:

- Elimination of uncontrolled liquid discharges from the site;
- Landfilling solids from the scrubber and S-X ponds at an on-site landfill;
- In-place capping of the wind-blown calcine, roaster reject, reject fertilizer, and active calcine tailings during 2000 and 2001;

- Semi-annual ground water monitoring to determine the effectiveness of source control, and;

- Establishment of institutional controls in affected off-site areas to prevent ingestion of ground water for as long as the ground water exceeds the RBC.

2.0 DATA QUALITY OBJECTIVES

2.0 DATA QUALITY OBJECTIVES (DQO)

2.1 Remedy and Ground Water Monitoring Network Evaluation DQO

2.1.1 Introduction

The purpose of this section of the work plan document is to present the data quality objectives that will be used to assess the currently implemented site remedy specified in the ROD. The process used to develop the DQO is presented in Table 2-1.

The CERCLA process and the ROD require a periodic (5-year) re-evaluation of the remedy to assess progress in reaching original data objectives. The ground water remedy for the site is long-term ground water monitoring following removal of the uncontrolled liquid discharges (liquid source elimination). The second 5-year review of the site was conducted by the US EPA in 2007. In the review, it was noted that COC concentrations of manganese, molybdenum and vanadium exceed RBC in many wells and have exhibited flattened trends since the late 1990s. In some cases, concentrations of these COC have been increasing over the last several years. Additional investigation of site conditions is warranted to evaluate whether remedial actions that were completed at the site in 1997 and 2001 are reducing COC in the ground water as intended and will result in meeting site clean up performance standards, or whether other conditions may exist that are creating on-going contributions of COC to ground water.

On an August 7, 2008 conference call, EPA requested and Tronox agreed to develop DQO for the Addendum 1 Work Plan specifically to evaluate two of the follow up actions identified in the second 5-year review. The follow-up actions identified in the second 5-year review were:

- Evaluate practicability of remedy in achieving cleanup goals, and;
- Evaluate adequacy of current groundwater monitoring network for identifying the offsite migration of COC.

Table 2-1 summarizes the DQO and is organized according to these two follow-up actions identified in the second 5-year review.

2.1.2 Step 1 -State the Problem

Step 1 of the DQO process has four major components:

- A concise statement of the problem;
- A conceptual model of the environmental problem to be investigated with a preliminary determination of the type of data needed and how it will be used;
- A list of the planning team members and identification of decision makers or principal data users with the planning team; and,
- A summary of available resources and relevant deadlines for the study, including budget, availability of personnel, and schedule.

The problem statement relates to the observation that the current remedy is not attaining projected reductions in COC concentrations in ground water. The effectiveness of the remedy needs to be evaluated based on an updated conceptual site model (CSM), reflecting current site conditions. Contributing sources of COC not included in the original CSM need to be identified and characterized if they exist. Data from the characterization will be used to evaluate risk to human health and the environment. The risk evaluation will be used to maintain or modify the current remedy.

There are three precise problem statements to evaluate practicability of remedy in achieving cleanup goals, including:

- PS-1: Remedy is not attaining RBC for some COC in ground water 10 years following LSE. Trends for arsenic, manganese, molybdenum and vanadium are flat or upwards at some wells. Assessment of the existing remedy is needed.

- PS-2: In recent years, increasing COC in some of the wells downgradient of the former S-X and scrubber ponds suggest that sources not identified or characterized in the RI/FS may be present. Assessment of other potential sources is needed.

- PS-3: There is some uncertainty that RBC can be reached with the currently implemented remedy. Assessment of the original assumptions made for the remedy and current site conditions is needed.

There is one problem statement evaluating the adequacy of the current ground water monitoring network for identifying the offsite migration of COC, including:

- PS-1: The ground water monitoring network may be inadequate to identify flow paths from the site or to define the offsite extent of ground water COC exceeding the RBC.

The current CSM identified the primary source of COC as the former ponds. Discharge from the ponds migrated through the vadose zone to the shallow aquifer. COC mixed with ground water and migrated in the aquifer to the west towards the Monsanto wells and south towards Soda Springs. Solid sources from the site that are shown on Figure 1-3, Figure 1-4 and Figure 3-1were estimated to contribute a smaller percentage of the overall contribution to COC (about 15 percent of the total estimated mass to ground water) in the RI (Dames and Moore, 1995). Exposure to COC in ground water was not considered to pose a risk to the public because ground water was not being consumed and the public was supplied water from a potable water source that was unaffected by the site. Semi-annual monitoring of ground water on the former industrial site and at downgradient locations was required in the ROD to evaluate COC concentration changes over time and to detect new or previously unidentified ground water impacts.

The project team that will complete the work to be conducted include Tronox project members and their consultants. EPA and its technical team will provide guidance and oversight of the work conducted by the Tronox project team. Members of the team include:

- John Hatmaker, P.E. will manage the project for Tronox and be the primary decision maker for Tronox;

- Boyd Schvaneveldt, former Plant Manager, serves as the superfund project coordinator for Tronox;

- JB, Brown, P.G. will coordinate all aspects of the work for Tronox, provide oversight of field investigations, provide site sampling services and provide project deliverables for the Addendum 1 SOW;

- Scott Sprague, P.E., will review engineering designs, plans, provide field engineering services;

- Lori Robison, P.G., has previous experience with the site and will be lead on geochemical and modeling issues, and assess optimization for the ground water monitoring network evaluation for the site;

- Bill Ryan is EPA's project manager for the Superfund site and will coordinate EPA's oversight of work conducted on the site;

- Clyde Cody will serve as the Idaho Department of Environmental Quality's technical lead and will provide oversight assistance for work conducted on the site; and

- CH2M HILL is EPA's consultant and will provide technical oversight support for work conducted on the site. Tim Mosko is the project manager for CH2M HILL.

All decisions will be made in a manner consistent with the Consent Decree for the site. It is the desire of both EPA and Tronox that all decisions will be reached by consensus.

The schedule is presented in Section 6.0 of the work plan. Deliverable date for the remedy evaluation report is scheduled for one month following approval of the work plan.

2.1.3 Step 2 - Identify the Decision

The purpose of Step 2 of the DQO process is to address the principal study questions that need to be answered to address the problem statements identified in DQO Step 1 and the alternative actions (AA) that would assist in the resolution of these questions.

The principal study questions and AA are then combined into decision statements (DS) that provide a choice among alternative actions. Table 2-1 presents the task-specific principal study questions, AA, and resulting DS. This assessment takes into consideration human health, the environment, economic, and legal ramifications. The principal study questions to address the problem statements are presented in Table 2-1.

2.1.4 Step 3 – Identify Inputs to the Decision

The third step of the DQO process identifies the types and sources of information needed to resolve the decision statement and to provide estimates of the conditions of the level of COC in the aquifer and inputs as to whether new data collection will be required to fill data gaps. This step provides a basis for initial planning for appropriate investigative and analytical approaches and performance or acceptance criteria. Sources of information to resolve decision statement are presented in Table 2-1.

2.1.5 Step 4 – Define the Boundaries of the Study

The primary objective of Step 4 of the DQO process is to identify the population of interest, define the spatial and temporal boundaries that apply to each decision statement, define the scale of decision making, and identify any practical constraints that must be taken into consideration in the sampling design. Implementing this step assures that the sampling design will result in the collection of data that accurately reflect the true condition of the site under investigation. Study area boundaries are presented in Table 2-1.

2.1.6 Step 5 – Develop a Decision Rule

The purpose of Step 5 of the DQO process is to develop a decision rule for each decision statement in the form of an “if…then” statement that incorporates the parameter of interest, the scale of decision making, the action level, and the alternative action(s) that would result from resolution of the decision. Decision rules presented in step 5 in Table 2.1 are those that were developed to evaluate practicability of remedy in achieving cleanup goals and for evaluating the adequacy of current ground water monitoring network for identifying the migration of COC from the site. Decisions will be based on existing data, the adequacy of the data, professional judgment and identified data gaps.

2.1.7 Step 6 – Specify Tolerable Limits on Decision Errors

Analytical data and field measurements can only estimate the true condition of the site under investigation at the time they are gathered and therefore, there can be uncertainties related to decisions that are made based on measurement data (i.e., decision errors). No additional analytical data are being collected for this phase of the remedy evaluation. Therefore, the Acceptable Limits on Decision Errors presented in Step 6 in Table 2-1 are those that were developed specifically for this aspect of the work to evaluate practicability of the remedy in achieving cleanup goals and for evaluating the adequacy of current ground water monitoring network for identifying the migration of COC from the site.

2.1.8 Step 7 – Optimized Design

Table 2-1 presents the optimized design for the evaluation of the remedy. The objective of Step 7 is to present alternative data collection designs that meet the minimum data quality requirements specified in Steps 1 through 6. A selection process is then used to identify the most resource-effective data collection design that satisfies the data quality requirements. However, the final optimized designs will be completed following a review of the inputs to the decisions, data and other sources of information. An evaluation of construction records and O&M records, existing data and detailed inspection of site conditions and of changed site conditions since the RI will be used to identify data gaps prior to any optimization of additional data collection investigations following the evaluation of the remedy as specified in the Addendum 1 SOW.

The optimized design for evaluating practicability of the remedy in achieving cleanup goals include:

- Conduct an evaluation of available analytical data, as-built, and/or other applicable site data such as field reconnaissance survey data to assess if unidentified, unmitigated, potentially contributing sources are adding COC to ground water;

- Conduct an evaluation of available analytical data and applicable site data to assess if and when COC will achieve RBC;

- Evaluate whether data are sufficient to assess if source remedy components are functioning to control the sources as designed and installed;

- Assess if estimated times to achieve RBC is reasonable;

- If data are not sufficient, then take additional action, including collection of additional samples through further site characterization of other potential sources that may be impacting the current remedy and assess if the source remedy is adequately controlling the source and is functioning as designed or whether an alternative time frame for ground water to achieve the RBC is reasonable;

- If existing and/or new data indicate that the remedy is not adequately controlling the source (not functioning as designed), or that other unidentified, unmitigated, potentially contributing sources are present and may be contributing to the failure of the current remedy to meet RBC in a reasonable time period, take additional action including remedial design and corrective action, as necessary.

- Ensure approved protective institutional controls are in place and enforceable until RBC are achieved.

The optimized design for evaluating the adequacy of the current ground water monitoring network for identifying the offsite migration of COC includes:

- Conduct an evaluation of available analytical and hydrogeologic data and other applicable site data to evaluate whether additional ground water monitoring coverage is needed, and;

- If additional coverage is needed, then prepare a work plan to complete coverage with an appropriate number of well installations.

3.0 SITE REMEDY EVALUATION

3.1 General

Addendum 1 to the SOW requires Tronox to evaluate the site remedy relative to meeting the cleanup performance standards that are specified in the ROD. In order to complete this task, the major components of the remedial actions will require a review of documents and components in the field to assess whether the components are functioning as intended when installed in 1997 and 2001. Other factors affecting the levels of COC in ground water may include the geochemical characteristics or hydrogeologic properties of the aquifer, contributions from sources that were not adequately addressed or identified in the RI, or factors resulting from changed conditions at the site since the RI/FS or time that the ROD was implemented.

The majority of the wells installed during the RI show that the COC concentrations in ground water were reduced as a direct result of removal of the unlined pond liquid sources. A number of downgradient wells currently continue to show steady decreases in COC concentration following remedy completion. Downgradient surface water and springs also continue to show decreasing molybdenum concentrations and are approaching the RBC. However, a few wells located downgradient from the former S-X and scrubber ponds on the former industrial site continue to indicate elevated levels of arsenic, manganese, molybdenum and vanadium. Organic compound COC exceed the RBC in one well near the former S-X pond.

During the RI, the ground water pathway was identified as the most significant exposure pathway at the site. Site impacts to ground water caused by seepage from on-site ponds were identified as the major contributors to COC in ground water, as indicated on Figure 3-1 and in Table 3-1. Leachate generated in the vadose zone from infiltration of precipitation through the solid sources contributes to observed concentrations of COC, but the contribution was estimated during the RI to be small when compared to the mass contribution of COC from the pond seepage.

The remedial investigation identified the solvent extraction pond, scrubber pond and active calcine pond as major contributors to ground water impacts, as shown on Figure 3-1. Approximately 300 to 350 gpm of water infiltrated through the bottom of these three ponds. Although the S-X and scrubber ponds were closed in 1997, precipitation in the form of rain and snow continued to infiltrate the calcine tailing into mid-2001 prior to reshaping and capping the tailing in place.

Off-site ground water impacts were also identified. Off-site ground water impacts are defined as those that occur beyond the points of compliance, or beyond the approximate 80-acre area that defined the plant facility boundary in the RI. The greatest off-site impacts were observed in the easternmost Monsanto monitor wells that are located directly west of the site across Highway 34. Off-site concentrations of molybdenum and vanadium were also observed at Finch Spring, while Big Spring indicated the presence of molybdenum at concentrations larger than the RBC.

3.2 Current Remedy Description

3.2.1 Elimination of Uncontrolled Liquid Discharges

Four uncontrolled liquid discharges (S-X Pond, scrubber pond, calcine ponds and Magnesium Ammonium Phosphate (MAP) Ponds) were identified during the Remedial Investigation. These liquid discharges included solvent extraction raffinate, roaster scrubber water and process water used to sluice the calcine to the calcine ponds. The MAP ponds were eliminated in 1993 during the RI. The solvent extraction raffinate stream was redirected to a series of lined ponds constructed in 1995 and 1997 (shown on Figure 1-3). Baghouses were installed on the roasters replacing the wet scrubbers, which eliminated the scrubber water stream. The calcine produced by the vanadium facility was handled by a de-watering system. The water was returned to the vanadium plant for reuse and the “de-watered calcine” was transported to the storage area by means of loaders.

These activities terminated the process streams to the S-X, scrubber and calcine ponds where the uncontrolled liquid discharges were occurring. This work was completed between 1995 and 1997. The purpose of the liquid source elimination portion of the project was to eliminate the infiltration of 300 to 350 gpm of process water.

The vadose zone beneath the S-X, MAP and scrubber pond basins were not addressed in the RI/FS or RD/RA because the focus was on eliminating the liquid sources. The S-X and scrubber ponds were full during the RI phase of the project. Residual surface water was present in the scrubber pond basin and within some cells of the calcine ponds in 1997 during the period of remedy implementation. If the characterization of the vadose zone beneath these pond basins is identified as a data gap during the remedy evaluation, this data gap will be identified in the draft remedy evaluation report.

3.2.2 On-Site Landfill Construction

The sediments remaining in the S-X and scrubber pond basins were excavated to native soil or to the calcine material beneath the S-X pond and placed in a lined on-site landfill, shown on Figure 1-3. The landfill construction was completed in 1997. Calcine is found beneath much of the S-X pond and the areal extent of the calcine is not known, but is shown on Figure 1-4. This calcine material was deposited on either native soils or possibly on basalt.

Following excavation of the sediments from the S-X and scrubber ponds, the pond basins were backfilled with clean native soil and contoured with a positive slope. The cover material was seeded to prevent erosion.

Approximately 13,000 cubic yards of material were removed from the two ponds and placed in the on-site landfill. The landfill was constructed with primary and secondary liners, leachate collection and an engineered geomembrane cap and soil cover. The cover was seeded to prevent erosion and the landfill footprint area was fenced to control access. Excess liquid contained by the waste when it was compacted in the landfill was removed through the leachate collection system. This liquid was pumped to the west 5-acre lined pond until 2004. The sump discharges a small volume at this time which is currently pumped to a lined concrete impoundment. The decrease in leachate removed from the sump (initial construction water used to achieve optimum compaction) suggests that the landfill cover and liner are operating as designed.

3.2.3 Capping In-Place of the Calcine

The 2000 ROD amendment required that the calcine that was used in the fertilizer process, roaster reject and off-spec fertilizer be capped within the footprint of the calcine impoundment. The cap construction was completed in 2001. The roaster reject and off-spec fertilizer were compacted within the calcine area prior to capping. The calcine material was compacted and sloped and an engineered geomembrane cap was placed over the material. The engineered cap consisted of linear low-density polyethylene (LLDPE), overlying geocomposite, subsoil and topsoil. After the topsoil was placed and smoothed, the entire area was seeded to control erosion. The entire area was fenced to control access.

3.2.4 Institutional Controls

Institutional controls required in the ROD included deed restrictions, access restrictions, well drilling restrictions and wellhead protection. Deed restrictions were placed on the property to the south of the facility in 1995 because COC were identified in ground water in this area in off-site wells KM-15 through KM-18. Kerr-McGee/Tronox subsequently purchased this property in 2004. The City of Soda Springs currently implements restrictions on land development and use through the building permit requirements, but does not have an enforceable means of restricting the development of ground water as a drinking water source. The property west of the facility includes a railroad right-of-way, highway right-of-way and property owned by Monsanto Chemical Company. Beneficial ground water development on any of these parcels is not likely.

Ground water to the north and to the east of the site is upgradient and not impacted by the former plant operations.

3.3 Remedy Evaluation

This section describes the approaches, methodologies and information sources that will be used in the remedy evaluation. Also described are tasks that will be completed to evaluate each of the remedial actions. The evaluation of the remedy will be for the purpose of assessing whether each facility component is functioning as designed and installed and whether site-specific conditions may exist that need to be addressed to improve the operation of each remedy. An evaluation of the potential sites contributing COC to ground water, those sites already identified and investigated and previously uninvestigated potential COC contributors, is included in a later section.

Collection of additional environmental data may be required to address data gaps identified as the outcome of the work detailed in this plan for the remedy evaluation. Additional data collection will also employ the use of data quality objectives The use of the DQO will define the criteria that will be required for data collection, including when, where and how many samples will be required for collection, and the tolerable level of decision errors for the study to assure that the type, quantity, and quality of environmental data used in decision making will be appropriate for the intended application. In this case, the application would be to identify unmitigated source(s) not identified during the RI that provide on-going contribution to COC in ground water. This approach will help to prevent the commitment by Tronox of unnecessary resources to data collection efforts that do not help to fill data gaps that will first be identified in the draft remedy evaluation report.

Once the components of the remedy and the data are reviewed and inspected, as detailed in this work plan, data gaps will be identified in the remedy evaluation report. These data gaps will dictate what actions may result in order to resolve the issue of whether decreasing concentrations rates of ground water COC are affected by uncontrolled site solid sources, as the result of a slower than predicted decay of COC in the ground water regime, or are affected by other factors such as the geochemical conditions within the aquifer. Specifically, these additional measures that could be recommended at the time of draft remedy evaluation report will include:

- Identification of the types of studies and data necessary, including evaluations of uninvestigated sites;
- Identifying the condition of the components of the remedy that could be in need of repair or indicate a potential for ponding or increased infiltration rates;
- Identification of the boundaries and the number of sites required for additional environmental media collection;
- Identification of the types of samples to be collected from soil and water;
- Identification of bounding or statistical COC action levels in environmental media such that a statement can be made as to whether concentration data indicate contributions from uncontained solid sources;
- Identification of potential technologies for treatment;
- Establishing the level of confidence from obtained environmental data with which decisions can be made, and;
- Optimization of a field sampling plan design, including evaluation of information from the draft remedy review report and generation of a field sampling plan that incorporates the most resource-effective design that meets the DQO.

3.3.1 Evaluation of LSE

Four pond basins contained process water during the operation of the vanadium plant. The calcine area was capped with an engineered geomembrane cover as described earlier. The S-X and scrubber pond basins were contoured after the sediments were removed, covered with soil and seeded. The material used to cover these pond basins were undisturbed native soils that consists mainly of loess (wind-derived silt) that was contoured to provide positive grade and shed water from the covers. Since the vanadium plant no longer exists, there are no known liquid discharges from the facility.

During the RI/FS, LSE was evaluated in conjunction with continued infiltration of precipitation through the solid sources in the ground water model (Dames & Moore, 1995) in order to estimate the effects of removing the ponds from service.

In order to evaluate the continued effects and performance of the LSE to ground water impacts, both document and existing data review and field studies will be implemented. Ground water COC data will be evaluated in conjunction with the timing of cessation of uncontrolled waste stream discharges (October 1997) to estimate the relative change in ground water COC concentrations that resulted from LSE. Methods used to evaluate the data will include the Mann-Kendall analysis, graphical interpretation of the normalized data, regression, or other similar methods. The results will be summarized in tabular form and evaluated.

A site inspection of all of the known solid source sites identified during the RI will be made to assess the conditions to compare with those assumptions used in the model. All available documents generated during the RI/FS will be referenced for this task. Prior to inspecting the former pond sites, records from inspections done by Tronox/KMCC personnel at the facility will be reviewed.

The two uncapped pond areas, the S-X and scrubber ponds, will be inspected for signs of erosion, deep tap-rooted plants, burrowing animals and areas where standing water may have been present following snow melt. The purpose of the inspections of these facilities will be to determine if there is a potential for infiltration of concentrated surface water runoff through the covered areas. This inspection will be completed establishing a 50 foot by 50 foot grid on the S-X pond and 30 foot by 30 foot grid on the scrubber pond cover, as shown in Figures 3-2 and 3-3. The grid sizes were selected so that the entire surface of the covered pond basin will be inspected. The grid lines will be superimposed over the map of the former ponds in north-south and east-west directions. The grids at each site will be established by placing stakes or flagging at 50-foot intervals on each side of the S-X pond basin and 30-foot intervals on each side of the scrubber pond basin. These stakes will be used to align the inspector during the inspection to ensure that the grid is covered. The inspector will use a tape, pedometer or similar device and compass to establish the grid. The grid points will be located using a hand-held GPS.

Each grid line will be inspected for any of the conditions listed above. The inspector will walk at a pace slow enough so that the area on both sides of the grid line can be observed and so that the vegetation does not hinder the observer. This pace will be slower than a normal walk. Observations made while walking each grid line will be recorded in a field notebook and on the map grid that will be included in the evaluation report. Photographs will be taken of each pond site and of problem areas if these are identified. These problem areas will also be located using a hand-held GPS. Site conditions observed during the inspection will be compared against the condition assumptions made for vadose zone infiltration during ground water modeling. Existing ground water data will also be evaluated to assess whether a connection may exist between infiltration through these areas and impacts to ground water quality. This work will be completed during the summer months after the vegetation has sprouted. However, this work should be done while any evidence of previously standing water can still be observed, if possible.

3.3.2 On-Site Landfill Evaluation

As part of the on-site landfill design for the remedial action, an operation and maintenance (O&M) plan was prepared. This O&M plan required that periodic inspections of the landfill be completed and recorded. Inspection records at the facility will be reviewed. It was stated in the five-year review report that the landfill was constructed as designed. However, the construction records will be reviewed as part of this evaluation.

A field inspection of the landfill cover will be conducted as described in a Section 3.3.1 using a 50 foot grid. The landfill was constructed with both GCL and 60-mil HDPE liners and a geomembrane cover. This design will not allow water to infiltrate either from the surface or subsurface. The water that has been removed is the water used during the construction of the landfill so the material placed in the landfill could be properly compacted. If there were any cover infiltration, this water would be recovered as leachate and pumped to the concrete impoundment. The concrete impoundment that holds water pumped from the sump is the remaining sulfuric acid tank containment structure made of reinforced concrete that is coated with chemical-resistant non-porous Permatec 5000 that was applied in 125 to 250 mil thickness (Tronox, 2008). Records indicate that pumping rates from the landfill have decreased over time, so the cover and liner appear to be operating properly.

3.3.3 Calcine Cap Evaluation

In order to evaluate whether the calcine cap is functioning as designed and installed, a field inspection of the facility will be completed. The remedy required capping of the calcine in 2000, essentially reducing the infiltration rate to near zero. An O&M plan was prepared for the calcine cap design. This plan required periodic inspections of the calcine cap. Inspection records performed by personnel at the facility will be reviewed prior to the field inspection described herein. It was stated in the five-year review report that the calcine cap was constructed as designed, but the construction records will be reviewed as part of this evaluation.

This inspection will be completed by establishing a 50 foot by 50 foot grid on the calcine cap as shown in Figure 3-4 and described below. This grid size was selected so the entire surface of the calcine cap will be inspected. As shown in Figure 3-4, the grid lines will run north-south and east-west. The purpose of the inspection will be to determine whether a potential for infiltration exists through the covered area, and whether runoff from the cover could be affecting adjacent areas. The grid will be established by flagging the surrounding fence on 50-foot intervals on all sides of the cap. These stakes will be used for alignment during the inspection to ensure that the grid is covered. The inspector will use a compass and pedometer or similar device to aid in the alignment with the flagging. The grid points will be located using a hand-held GPS.

Each grid line will be walked to observe any signs of erosion, deep tap-rooted plants, burrowing animals, tension cracks and evidence of standing water. The outside edge of the calcine cap will walked to look for evidence of water flowing along the geonet that could result in erosion and potential failure of the soil cover system. The inspector will walk at a pace slow enough so that the area on both sides of the grid line can be observed and so that the vegetation does not hinder the observer. This pace will be slower than a normal walk. Observations made while walking each grid line will be recorded in a field notebook. Photographs will be taken if problem areas are identified. These problem areas will also be located using a hand-held GPS. The location of any problem areas will also be plotted on the map grid of the calcine cap to be included in the draft remedy evaluation report.

This work will be completed after snowmelt and after the vegetation has sprouted. However, this work should be done while any evidence of standing water can still be observed. Areas of standing water need to be identified because if they are in the same area as burrowing animals, deep tap-rooted plants or other conditions that may have damaged the synthetic liner, the standing water could infiltrate into the calcine and possibly reach ground water.

The calcine cap was constructed to prevent infiltration through the calcine. As a consequence, the cap sheds water during the spring snowmelt and following significant rainstorms. In order to assess this volume, precipitation data from Tigert Airport will be evaluated from 2001 to the present in conjunction with storage capacity of the soil cover to estimate the amount of water that could runoff the cover and influence infiltration through other areas around the calcine area, including the scrubber pond cover. The purpose of this assessment is to determine if there is a large amount of water available to infiltrate adjacent areas to the cap.

3.3.4 Ground Water Model Review

Although the ground water model is not part of the site remedy, the model was used for comparative analysis of remedial action alternatives for the site. The ground water model completed as part of the FS was the basis for determining the timeframe that COC concentrations would reach the risk-based concentrations at the point of compliance. However, the emphasis of the ground water model prepared as part of the FS was to predict and compare the magnitude of concentration changes for the different remediation scenarios. The model was not intended to predict the exact concentrations that would result at any particular location for a specific remedial scenario (Dames & Moore, 1995a). However, comparisons were made in the model to regulatory levels such as RBCs and MCLs to provide context for the predicted changes in COC concentrations (Dames & Moore, 1995a).

The purpose of reviewing the ground water model will be to compare the modeled conditions with the existing site conditions to identify where differences may exist. The inputs and assumptions made during the modeling process will be reviewed. Data that will be reviewed include, but are not limited to, source concentrations, infiltration of precipitation, adsorption coefficients from the available scientific literature, ground water velocity and ground water direction. If new information indicates that inputs or assumptions used in the model are inconsistent with site conditions since the model was accepted, the impact of such conditions will be described based on the sensitivity analyses completed in the model.

3.3.5 Institutional Controls

The institutional controls for this facility have been in place since 1995 and nothing has changed to indicate that these controls require modification. Tronox will review the existing institutional controls to determine their adequacy using the guidance found in EPA 540-F-00-005, OSWER 9355.0-74FS-P, dated September 2000 and will work with

EPA to locate the implementation plan for required institutional controls, which was to be developed as part of the Remedial Design

3.4 Factors Influencing COC Concentrations in Ground and Surface Water

The ground and surface water sampling monitoring program has been in place since the commencement of the RI in 1991. These data show that concentrations of vanadium and molybdenum exceed the risk-based concentrations at most of the point of compliance wells at or near the plant facility boundaries. There are several factors that may be influencing the COC concentrations in ground water. These factors will be assessed and include changes in ground water flow direction, changes in ground water velocities, changes in ground water elevations, changes in pH, variability of precipitation and evapotranspiration, uncertainty regarding possible influences from COC in the vadose zone, the absence of low permeable covers over the S-X, MAP and scrubber ponds, a possible failure of the landfill liner that was constructed in 1997 and the influence of ground water pumping by Monsanto.

There is a significant amount of data collected from each of the monitor wells that were installed as part of the RI. The RD/RA data set collected since the implementation of the remedy will be used (November 1997 to the most recently available data) and no additional data will be collected for this evaluation. Additionally, the data results from a shorter period of time (May 2004 through May 2008) will be evaluated in conjunction with the November 1997 through May 2008 data set to assess whether the more recent data set demonstrate trends that are notably different from the overall LSE time period.

These data sets will be reviewed and trends will be analyzed using regression analysis for this evaluation and the evaluation described in Section 3.6. Existing ground water data will be evaluated using a statistical forecast function for exponential decay. A forecast calculates or predicts a future value by using existing values within each of the two data sets. The predicted value is a y-value (future concentration of a COC in ground water) for a given future date. The known values are ground water data from the wells from each of the two data sets. A forecast statistically predicts future values based on a regression function of a range of known data or known x- and y-arrays. Regression analysis estimates the relationship between variables, so that a given variable can be predicted from one or more other variables.

Data curves for the ground water and surface water concentrations will be generated using an exponential function that describes decay of a substance (in this case, molybdenum and vanadium) and calculates the least squares fit through points by using the equation:

$y = ce^{-kt}$

where:

e is the base of the natural logarithm;

c is a constant at y_0 (initial concentration) at t = 0, and;

$^{-kt}$ is a constant for the predicted time, with the minus sign representing decay of concentration with time.

A trend line, regression coefficient (r^2) and equation for that trend line are generated for the data set based on known x-values for the best-fit curve. The y intercept for the regression trendline is set at zero. This intercept is appropriate, based on the observed absence of manganese, molybdenum and vanadium in background ground water quality data.

The draft remedy evaluation report will include a LTMO analysis using the Mann-Kendall test. This test is a non-parametric statistical procedure used to analyze data that do not follow a normal distribution. The Mann-Kendall statistic (MK(S)) is derived from the differences in concentrations between consecutive sample results. A positive value (+1) is assigned if there is an increase in concentration, a zero value (0) if there is no change, and a negative value (-1) if there is a decrease in concentration. The Mann-Kendall statistic is defined as the sum of the number of positive differences minus the number of negative differences. The strength of the trend is proportional to the magnitude of the MK(S). The confidence in the trend is the statistical probability that the constituent concentration is increasing (S>0) or decreasing (S<0) and is calculated using a Kendall probability table. A relative concentration trend is assigned based on the relationship between the Mann-Kendall statistic and the confidence in the trend. Results will include the regression coefficient (r^2) values for the regression analyses and the confidence factor. A "Seasonal Kendall Test" will be applied to those wells demonstrating seasonality in the data. Evaluations for wells demonstrating seasonality will be completed with both the high water level season and the low water level season COC concentration data sets for the agreed-upon evaluated periods.

The influences of ground water flow direction will be assessed. There may be changes in the ground water flow direction of ground water velocity as a result of the remedial actions taken. The purpose of this evaluation will be to assess if these changes influence COC concentration in ground water. An additional factor that may influence COC concentrations in ground water is the effects of ground water elevations. The ground and surface water database will be reviewed to assess whether changes in ground water elevations resulted from the remedial actions and if ground water elevation changes are influencing COC concentrations in ground water.

The impact to ground water quality and water levels as the result of precipitation will be analyzed by reviewing precipitation records for Soda Springs and comparing these records to changes in COC concentration in ground water. The purpose of this review will be to assess the impacts that changes in long-term precipitation may have on ground and surface water quality trends.

In order to assess potential site-specific factors that may be influencing COC concentrations in ground water and surface water, Tronox will collect dissolved oxygen (DO) and oxygen-reduction potential (ORP) in addition to the field parameters currently being collected. The purpose of the addition of these field parameters will be to gain a better understanding of the redox conditions beneath the site and this potential affect to the persistence of COC in ground water. The following analytes will also be added to the analyte list for the laboratory:

- Dissolved iron;
- Dissolved manganese;
- Ammonia;
- Total organic carbon (TOC), and;
- Silica.

The additional field parameters and laboratory analyses will be completed for at least two sampling rounds. Monitor wells KM-1 and KM-10 will be included in the October 2008 sampling event. Samples collected from these wells will be analyzed for the same parameters as the routinely monitored wells.

3.5 Potential Sites Affecting COC Concentration

Following LSE, a number of monitoring wells near pond facilities responded with notable decreases in ground water concentrations of COC. However, a flattening of the COC concentrations was identified in the data for a number of wells, including those listed in Table 3-2, suggesting that concentrations of predominantly molybdenum and vanadium remained in the ground water for periods longer than were predicted by the ground water model. In a few instances, ground water COC concentrations showed rises following increased period of precipitation. Therefore, data gaps identified in the remedy evaluation report will be recommended for further investigation to assess whether remaining uncontrolled solid sources within the vadose zone are contributing to COC in ground water.

During the remedial investigation known source areas were identified and investigated, including the S-X pond, scrubber pond, active calcine area and west side calcine area as shown on Figure 3-5. The results of these investigations are documented in the

Kerr-McGee Chemical Corporation Final Remedial Investigation Report; Soda Springs, Idaho Facility (Dames & Moore, April 1995). Other potential source areas, such as the vadose zone beneath the S-X and scrubber pond footprints, and the vadose zone beneath the limestone settling ponds, shown on Figure 3-5, may have been identified and not field investigated. During the RI/FS, the former S-X and scrubber pond basins contained 2 to 9 feet of water and up to 7 feet of liquid sediment. The RI/FS and subsequent remedial actions did not address the vadose zone in these locations because these sites were in the process of being dewatered at the time the work for the remedial action was being completed. The emphasis of the remedial action was to eliminate the liquid sources. Recommendations for any further investigation of these areas will be included in the draft remedy evaluation report with a specific field sampling plan to fill this data gap.

Site conditions and activities that have occurred since the RI are shown in Table 3-3. If activities identified since the completion of the RI have the potential to impact the levels of COC in ground water, or information collected in the work outlined in this plan identifies sources that have not been adequately addressed in the RI that could impact ground water concentrations, these will be evaluated as to whether the current level of information will allow for the assessment of the COC impact to ground water. If additional investigation or data collection is required to make this assessment, EPA will be notified in writing as to the scope and required data needs to meet the objectives of this evaluation.

3.5.1 Former Solvent Extraction and Scrubber Pond Basins

As part of the remedial actions for the facility, changes were made to eliminate the flow of process water to these ponds. The sediments were excavated once the ponds had dried, and then compacted at optimum moisture in the on-site landfill. Both of these ponds were in service for more than 20 years. Removing the liquid head above the vadose zone removed the driving force for COC to reach ground water. This resulted in an immediate decrease of COC concentration in ground water. However, the vadose zone beneath the former ponds represents relatively unknown conditions.

Figure 3-5 shows that no information currently exists from the RI as to the nature and condition of the soils beneath these pond basins. However, the detailed cover inspection that will be performed will identify whether ponding exists at low points on the covers. If during the course of the evaluation of the remedial action either of these locations is identified as not being adequately addressed during the RI, or if data indicate these as a potential source of COC to ground water, these data gaps will be noted and a field sampling plan developed through the DQO process will be developed to evaluate the vadose zone at these locations.

3.5.2 West Side Calcine Impoundment

Calcine from the early operation of the facility (1963 through 1972) was impounded on the west side of the facility as shown on Figures 1-3 and 1-4. This impoundment was loosely covered with native soil ranging in thickness from about 6 inches to 5 feet and seeded after the calcine impoundment area was moved to the east side of the facility in 1972 as shown on Figure 1-4. This impoundment area covers approximately 13 to 17 acres, although the exact boundary is not currently delineated.

This area was investigated in 1992 during the RI through a series of borings (B-1 through B-4 shown on Figure 3-5) and by installing a lysimeter in the calcine and in the soil below the calcine in one boring (B-1). The RI determined that the west calcine area was limited as a contributing source to COC in ground water based on one lysimeter point location and, therefore, no remedial actions were taken in this area.

The data collected during the RI, including a review of the boring, lysimeter and modeling inputs and infiltration modeling will be reviewed to determine whether the assumptions made for this area as a potential source to ground water contamination are still valid and whether contributions from this source were adequately assessed in the

RI. This review will include an inspection of the site surface cover in the same way that the S-X pond basin will be inspected, reviewing the methodology of data collection, the analytical and boring data that was collected and how the data was presented in the findings of the Final Remedial Investigation Report.

3.5.3 Calcine Cap Area

The calcine cap covers approximately 26 acres. The cap is relatively impermeable, and as a result, the cap reduced the area available for infiltration of precipitation and decreased the rate of infiltration to near zero inches per year. However, the drainage net on the cap has resulted in concentrated surface water runoff off the cap in the spring from accumulated windblown snow in the winter months. Spring snowmelt is collected on the north side and on the south side of the cap in areas of topographically lower elevation. Infiltration basins were constructed in these areas within clean soils and outside of the former pond and impoundment to promote infiltration of snowmelt and clean surface runoff water from the cap. Calcine cap construction may have resulted in a change in the direction of ground water flow. This effect will be assessed during the evaluation of the ground water monitoring network task by comparing the previous ground water elevations with the current ground water elevations to determine if there has been a change in the ground water direction.

The ground water elevation data, data from the cap construction and bedrock elevation data from test pits and borings will be reviewed to infer whether the calcine under cap is coming into contact with ground water or if ground water could be contacting the soils in the vadose zone beneath the footprint of the former scrubber pond. Timing of the infiltration basins construction and operations will be reviewed for correlation with changes in ground water concentrations in wells near these locations.

3.5.4 Limestone Settling Ponds

During the operation of the vanadium plant and the operation of the S-X pond on the west side of the facility (1968 to 1996) the S-X raffinate stream was neutralized by adding limestone slurry to the stream. This stream flowed to a series of ponds upstream of the S-X pond where the limestone settled out of the stream and the clarified liquid flowed to the S-X pond. The location of these limestone settling ponds is shown on Figure 1-4. These ponds also collected storm water runoff from the facility while the facility was in operation.

There were two types of settling ponds used during the operation of the facility. The original ponds were unlined earthen pits. These unlined ponds were in operation from 1974 to 1988 when they were replaced with ponds that were lined with a single high density polyethylene liner. The lined ponds were operational between 1988 and 1995, and cleaned out of all water and sediment and liner materials in 2003. No data have been collected from beneath either the unlined or lined ponds, however, visual inspection of area following liner removal indicated that contained solids had not leaked from the ponds and that little to no staining was noted on underlying soils or underlying calcine. Ground water modeling showed little impact from these ponds because of the presence of the liners.

However, the material contained in the unlined pond basins and the vadose zone beneath all of the ponds has the potential to contain COC. The area will be inspected in a similar manner as the S-X pond for low spots of water ponding at the surface (see Section 3.3.1 for details regarding the inspection). Historic site photos will also be reviewed.

3.5.5 Former Vanadium Plant

The former vanadium plant rests on very shallow soils and bedrock. Demolition of the vanadium plant was completed in 2002, and materials from the demolition were shipped to an appropriate receiving landfill or recycled. The footprint of the former plant was covered with fine limestone. This cover was contoured to shed water away from the former plant site. The former plant was not considered a source during the RI because process materials were contained and the floor of the plant predominantly consisted of concrete. However, an inspection will be made of the vanadium plant footprint. This inspection will be completed establishing a 50 foot by 50 foot grid on the former plant footprint. The grid for this inspection will be established as described in previous sections, either using flagging or stakes. Each grid line will be walked to look for any signs of erosion, areas of potential infiltration and areas where standing water may have occurred. Observations made while walking each grid line will be recorded in a field notebook. Photographs will be taken if problem areas are identified. The location of any problem areas will also be plotted on a map of the former plant footprint. Details of the inspections are shown in Section 3.3.1.

If during the course of the evaluation of the remedial action the former vanadium plant is identified as not being adequately addressed during the RI, or if data indicate these as a potential source of COC to ground water, EPA will be notified in writing that additional data collection will be required.

3.5.6 MAP Ponds

The magnesium ammonium phosphate (MAP) ponds were operational from 1973 to 1993 and were used to dewater MAP after it was produced so that it could be removed and sold as fertilizer. Process changes made in 1993 made these ponds obsolete. The MAP contained in these ponds was removed and the former pond basins were filled with soil. A portion of this area has been covered by a concrete floored building and asphalt road. This area will be evaluated in the field during the remedy evaluation for potential of ponding of surface water, and future recommendations to address this data gap will be identified in the draft remedy evaluation report.

3.6 Trends in Ground and Surface Water Quality

The existing data collected as part of the monitoring program will be evaluated in the draft remedy evaluation using regression analysis, and through the LTMO analysis using the Mann-Kendall statistic to evaluate the same data set. Two data sets will be used. The first data set will include only data from November 1997 to the most recent, the period following the implementation of the remedial actions. This truncation will be done to focus the evaluation on the trends following the implementation of the remedial actions. The second set of data will include data results from a shorter period of time (May 2004 through May 2008). These data will be evaluated in conjunction with the November 1997 through May 2008 data set to assess whether the more recent data set demonstrate trends that are notably different from the overall LSE time period. These evaluations will be done for each monitor well, each point of compliance monitor well, Finch Spring and Big Spring. The purpose of this evaluation will be to estimate when cleanup performance standards can reasonably be expected to be met.

There are a substantial amount of data collected from each of the monitor wells that were installed as part of the remedial investigation and monitoring program. This large data set will be used for the evaluation and no additional ground or surface water data will be collected for this evaluation. Other sources of data include data from the Evergreen Resources investigation being conducted by the City of Soda Springs and data from the east side of the Monsanto facility that was collected as part of the remedial investigation conducted at the Monsanto site, if these data are available. The Monsanto and Evergreen sites are downgradient of the Tronox facility. Observation of COC trends at these downgradient locations for a period following implementation of the remedy will be important information in evaluating the transport of COC in the basalt aquifer and will:

- Identify whether COC are increasing or decreasing at downgradient locations;
- Allow for comparison of on-site ground water trends with changes in off-site downgradient ground water quality with respect to COC;

- Provide additional downgradient data points to define that boundaries of ground water affected by COC from the site, and;
- Provide additional piezometric data points to delineate aquifer flow directions downgradient from the site

The influences of ground water flow direction will be assessed. Changes in the ground water flow direction or ground water velocity as a result of the remedial actions taken will be interpreted. The purpose of this evaluation will be to assess if these changes influence COC concentration in ground water.

3.7 Assessment of COC Trends in Off-Site Springs

Existing water quality data from the site monitoring program will be used to evaluate the connection between the site and off-site springs and changes in COC concentration in these springs. Current data suggest that COC concentrations are decreasing at downgradient springs with time. This evaluation of the downgradient springs will focus on the movement of COC from the site. Geologic and geochemical information collected during the remedial investigation will be used in this evaluation.

3.8 Current Remedy Evaluation Report

Following the completion of the work described in this section, a report that presents the findings of the current remedy evaluation will be written and submitted to USEPA Region 10 and IDEQ. The current remedy evaluation report will include information gathered during the evaluation of the remedy, the trends in ground and surface water observed during the evaluation, any connection between the site and off-site springs, identification of data gaps pertinent to the effectiveness of the remedy, updated conceptual site models based on the RI and post-RI data, a discussion of the validity and applicability of existing conceptual site models and recommendations for additional work that may be needed to complete the evaluation.

4.0 GROUND WATER MONITORING NETWORK EVALUATION

The purpose of the ground water monitoring network evaluation is to appraise the current ground water monitoring network. This evaluation will assess whether the existing monitor wells are adequately located and will identify whether the ground water plume is attenuating or migrating downgradient. Another objective of this work task is to evaluate whether the existing monitoring program can be optimized to be more efficient and provide the level of information necessary to evaluate the remedy.

4.1 Existing Ground Water Monitoring Network

The existing ground water monitoring network consists of 13 on-site monitor wells and 4 off-site monitor wells. These wells were installed during the RI and have been integral to the investigation and ground water monitoring programs. The locations of the monitor wells were selected during the RI to monitor a specific source or area. A description of the location of each monitor well is shown below. The monitor well locations are shown in Figures 1-3, 1-6 and 3-5.

Paired monitor wells KM-1 and KM-10 were originally intended to be the upgradient wells for the site and are located north and east of the former vanadium plant. Monitor well KM-1 is a shallow well completed in clay and tuff, whereas well KM-10 is an intermediate depth well completed in basalt. Since the time that these wells were installed, the two double lined 5-acre ponds were constructed to the north of the monitor wells, and then removed in 2004. The wells are not currently monitored for water quality parameters. However, these wells were monitored in the fall of 2008 and will be sampled again in the spring of 2009 for the routine and expanded analyte list to identify the current seasonal range of COC concentrations at this location and to assess redox conditions at this location.

Monitor well KM-2 is a shallow monitor well that is completed across the alluvium/basalt contact. This well is located near the southeast corner of the calcine cap. This well was intended to monitor the southern edge of the calcine impoundment area during the remedial investigation.

Monitor wells KM-3 (shallow) is completed in clay and tuff and well KM-11 (intermediate depth) is completed in basalt. These paired wells are located south of the former scrubber pond. These wells were intended to monitor the scrubber pond and calcine impoundment area during the remedial investigation.

Monitor well KM-4 is a shallow well located to the southwest of the calcine cap and is completed in cinders and tuff. This well was installed during the remedial investigation to monitor the calcine impoundment area and downgradient of the scrubber pond.

Monitor well KM-5 is located between the former boiler blow-down pond and former MAP ponds to the west and slightly north of the former vanadium facility. This well was installed to monitor the MAP ponds. Monitor well KM-5 is a shallow well and is completed in vesicular basalt.

Monitor well KM-6 is located south of the former limestone settling ponds and west of the former landfills. This well was intended to monitor the landfill and potential releases to the south from the facility. Monitor well KM-6 is a shallow well with a large hydraulic conductivity and is completed in vesicular basalt.

Monitor well KM-7 is located west of the former vanadium plant and east of the former S-X pond. Monitor well KM-7 is a shallow well that is completed in vesicular basalt and cinders. This monitor well was installed to monitor the ground water on the west side of the former vanadium facility in the vicinity of the west side calcine deposit.

Monitor wells KM-8 (shallow), KM-12 (intermediate depth) and KM-19 (deeper) are located to the west of the former S-X pond and were installed to monitor the S-X pond. Monitor well KM-8 is completed in clay and basalt. Monitor well KM-12 is completed in basalt and monitor well KM-19 is completed in clay and fractured basalt at the lowermost sequence of the basalt flows, immediately above the Tertiary Salt lake Formation.

Monitor well KM-9 is located near the southwest corner of the site facility boundary slightly south of the former S-X pond. Monitor well KM-9 is a shallow well completed in dense vesicular basalt. This monitor well was intended to monitor releases to the southwest from the site and is sited at one of the most downgradient locations from the former vanadium plant and S-X pond.

Monitor well KM-13 is a shallow well located west of the former S-X pond. This well was completed in dense basalt and intended to monitor releases to the west of the S-X pond.

Monitor wells KM-15 (shallow) and KM-18 (intermediate depth) are located south of the site and west of the Finch Spring Fault. Monitor well KM-15 is completed in cinders and basalt and KM-18 is completed in basalt. These paired monitor wells were installed to monitor releases from the site to the south of the site and west of the Finch Spring Fault. Both wells indicate similar COC concentrations.

Monitor well KM-16 is a shallow well that is completed in basalt. This monitor well is located to the south of the site, east of monitor well KM-15 and east of the Finch Spring Fault. This monitor well was installed to monitor releases to the south of the site and east of the Finch Spring Fault.

Monitor well KM-17 is located south of the site to the southwest of monitor wells KM-3 and KM-11. Monitor well KM-17 is a shallow well of relatively low permeability completed in silt and basalt. This monitor well was installed to monitor releases to the south from the facility.

4.2 Monitor Well Network Evaluation

The purpose of the draft monitor well network evaluation report will be to assess the adequacy of the placements of the wells and evaluate whether COC are attenuating or migrating downgradient. The evaluation will include the use of Monsanto and Evergreen data results from 2007 reports to assist in making these assessments.

The objective of the monitor well network evaluation is to identify whether the current network adequately identifies the off-site migration of COC. Therefore, a review of other studies, such as those at Monsanto and Evergreen are appropriate in addition to review of RD/RA site data to the present in order to gain a sufficient understanding of off-site flow paths that are downgradient of the site and to define ground water areas where COC are at largest concentration. Another objective of the study will be to assess concentration rate changes at downgradient locations to compare with on site ground water COC concentration decay resulting from LSE.

Questions that need to be answered by the monitor well network evaluation include whether downgradient ground water concentrations are increasing or decreasing concurrent with site ground water concentration trends. In order to make this assessment, site COC concentrations over time from ground water downgradient of the site, including Monsanto, Evergreen, Finch and Big Spring sites will require similar time comparison with site data. Data required to make this assessment will be vanadium and molybdenum concentrations obtained from sites that have sampling and analysis plans in place to ensure that the quality of these data meet the requirements of data quality objectives. Study boundary areas will include from the Tronox site south to the Evergreen facility, south to Finch Spring, then as far to the south as Big Spring where the most southern extent of COC are observed, The western extent of the study boundary area will be the production wells at Monsanto that represent the hydraulic low point to the west of the site. If areas beyond the site facility boundary show larger concentrations than those leaving the site, or if ground water COC downgradient are increasing with time, then additional ground water data may be required.

Each Tronox monitor well will be evaluated regarding its usefulness in the monitoring program. The purpose of this work is to determine if the existing monitoring network is sufficient to adequately monitor the site, if monitor wells can be removed from the monitoring program or if additional monitoring wells are required to adequately monitor the site. The criterion that will be used to evaluate the usefulness of the monitoring wells in the monitoring program includes the following:

- Location of COC plumes moving off the industrial facility site;
- Analytical data;
- Annual monitoring reports for the site;
- Location and source the monitor well is intended to monitor;
- Completion depth;
- Ground water quality trends from Section 3.6;
- Point of compliance or not;
- Monitoring frequency;
- Ground water elevation, and;
- Ground water flow direction.

Following the review of these data, a report will be written presenting the findings of this evaluation. The ground water monitoring network evaluation report will present the data used in the evaluation, present the findings and provide recommendations regarding the usefulness of each of the existing monitor wells and could recommend placement of other wells if the data indicate that the network is inadequate in identifying the off-site migration of COC.

An additional long-term monitoring optimization evaluation of the monitor well network will be completed for the draft remedy evaluation report. The MAROS, or other suitable program will be utilized to optimize the long-term monitoring strategy for the site.

5.0 REDUCTION OF ARSENIC DETECTION LIMIT

5.1 General

Addendum 1 to the SOW requires that all future arsenic analyses requested for ground and surface water samples are performed using analytical methods with reporting limits that are smaller than the MCL. The current arsenic drinking water MCL is 10 ug/l. The ROD set the RBC level at 50 ug/l, the MCL concentration at the time that the ROD was signed. The purpose of reducing method detection and reporting limits is to determine if the remedy that has been implemented is adequately protective with respect to the lowered arsenic standard.

The arsenic reporting limit used during the remedial investigation and the monitoring program prior to October 2007 was typically 15 ug/l. The analytical method used prior to October 2007 was EPA Method 6010 B. The laboratory contracted to analyze the ground water samples has been an accredited laboratory for the length of the project. The laboratory has gone through several name changes and is currently named Test America.

5.2 New Analytical Method and Reporting Limit

The ground water samples collected beginning in October 2007 have been analyzed for arsenic using EPA Method 6020 inductively coupled plasma-mass spectrometry (ICP-MS). The laboratory can achieve a reporting limit of 5.0 ug/l using this method, with a method detection limit of 0.21 ug/l. The new reporting limit is one half of the arsenic MCL for ground water (10 ug/l). This analytical method or other EPA approved method that results in a reporting limit that is less than the arsenic MCL will be used on all future analyses of water samples from the ground and surface water monitoring program at the Tronox Soda Springs, Idaho Facility.

The October 2007 arsenic results were compared with previous results to assess the impact of the reduced reporting limit. Results of this analysis were submitted to EPA in a letter dated March 26, 2008 and indicated that the EPA Method 6020 ICP-MS arsenic analytical method utilized in October 2007 did not result in a substantially different outcome with respect to the MCL when compared with previous testing results. Previously qualified arsenic results that fell below the 15 ug/l reporting limit prior to October 2007 contained concentration levels that were smaller than 5 ug/l.

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6.0 SCHEDULE

The schedule to complete the tasks detailed in this work plan are presented on Figure 6-1. This schedule is based on the work product delivery schedule set forth by EPA in the Addendum 1 to the SOW. However, final delivery dates for final work plan deliverables may be based on schedule slippage resulting from regulatory review and approval of draft documents, or could result in the event that additional work is required in order to evaluate the current remedy. This schedule includes submittal of the draft remedy evaluation report within 30 days following the approval of the revised draft work plan.

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TABLE 1-1

TABLE 3-7

SCREENED AND/OR TESTED INTERVALS AND ESTIMATED HYDRAULIC CONDUCTIVITIES OF MONITOR WELLS AND CORE HOLES

Well or Corehole No.	Well Depth Designation	Depth of Screened or Tested Interval (feet)	Basalt or Interflow Zone Number-a	Estimated Hydraulic Conductivities: Slug Tests-b (cm/sec)	Slug Tests-b (ft/day)	Specific Capacity Tests-c (cm/sec)	Specific Capacity Tests-c (ft/day)	Long-Term Pumping Tests-c (cm/sec)	Long-Term Pumping Tests-c (ft/day)	Packer Tests (cm/sec)	Packer Tests (ft/day)	General Lithology of Screened or Tested Interval
KM-1	Shallow	46 to 56	I4	7.2E-02	204							clay, tuff
KM-2	Shallow	47 to 57	Qb5	9.4E-02	266							basalt, clay
KM-3	Shallow	39 to 49	I4	3.2E-02	91	2.5E-02	72	3.4E-02	97			clay, tuff
KM-4	Shallow	44 to 54	I4	5.4E-02	153							cinders, tuff
KM-5	Shallow	38 to 48	Qb5	1.3E-02	37							vesicular basalt
KM-6	Shallow	35 to 45	Qb5	1.2E-01	340							vesicular basalt
KM-7	Shallow	46 to 56	Qb5/I4									vesicular basalt and cinders
KM-8	Shallow	35 to 45	Qb5			3.3E-03	9.4					basalt, clay
KM-9	Shallow	48 to 58	Qb5	1.7E-02	48							vesicular basalt
KM-10	Intermediate	100 to 120	Qb3									basalt
KM-11	Intermediate	80 to 100	Qb3	3.4E-02	96	1.2E-02	34					basalt
KM-12	Intermediate	134 to 154	Qb3	1.2E-02	34			2.8E-03	8			basalt
KM-13	Shallow	46 to 56	Qb5	6.1E-03	17							basalt
KM-15	Shallow	45 to 55	Qb5a/I5	3.7E-02	105	7.8E-03	22					cinders, basalt
KM-16	Shallow	63 to 73	Qb5	3.4E-02	97	1.2E-02	33					basalt

TABLE 1-1

TABLE 3-7

SCREENED AND/OR TESTED INTERVALS AND ESTIMATED HYDRAULIC CONDUCTIVITIES OF MONITOR WELLS AND CORE HOLES

Well or Corehole No.	Well Depth Designation	Depth of Screened or Tested Interval (feet)	Basalt or Interflow Zone Number-a	Estimated Hydraulic Conductivities: Slug Tests-b (cm/sec)	Slug Tests-b (ft/day)	Specific Capacity Tests-c (cm/sec)	Specific Capacity Tests-c (ft/day)	Long-Term Pumping Tests-c (cm/sec)	Long-Term Pumping Tests-c (ft/day)	Packer Tests (cm/sec)	Packer Tests (ft/day)	General Lithology of Screened or Tested Interval
KM-17	Shallow	38 to 48	Qb4/I3	1.9E-03	5	8.1E-04	2.3					basalt, silt
KM-18	Intermediate	153 to 173	Qb3	9.2E-03	26	2.9E-03	8.2					basalt
KM-19	Deep	194 to 214	Qb2/I1	2.4E-02	69	5.3E-03	15					fractured basalt, clay
CH-1		53 to 72	Qb3							1.7E-03	4.8	fractured, vesicular basalt
		72 to 91	Qb3/I2							3.1E-06	0.0088	fractured basalt, clay
		140 to 150	Qb2							2.7E-04	0.77	basalt
CH-2		41 to 50	I4							5.0E-03	14	cinders
		105 to 114	Qb3/I2							2.9E-03	8.2	clay, gravel
		132 to 141	Qb2							2.6E-03	7.4	vesicular basalt
		140 to 150	Qb2							1.2E-03	3.4	intensely fractured basalt
CH-3		35 to 44	Qb5							5.8E-03	16	basalt
		100 to 109	I3							3.5E-03	9.9	clay, gravel
		200 to 209	Qb2/I1							2.3E-03	6.5	basalt, gravel, clay
		220 to 229	Qb1/Tsl							1.2E-03	3.4	basalt, conglomerate
		240 to 250	Tsl							2.7E-04	0.77	sandstone, quartzite, clay
CH-4		34 to 443	Qb5							2.9E-03	8.2	basalt
		60 to 69	Qb5							2.6E-03	7.4	intensley fractured basalt
CH-5		59 to 68	Qb5							3.5E-03	9.9	vesicular basalt
		99 to 108	Qb3							1.9E-03	5.4	basalt
		140 to 150	Qb2							2.0E-05	0.057	massive basalt

a = Quaternary basalt sequences Qb1 through Qb5 and interflow zones I1 through I4.

b = If slug injection and withdrawl values were available, then the mean was used

c = Transmissivities estimated from the tests were converted to hydraulic conductivity by assuming that the screen length equaled the saturated thickness of the aquifer. If transmissivities were estimated using more than one analytical method, then the mean was used.

ADDENDUM 1
WORK PLAN

TABLE 1-2
MONITOR WELL CONSTRUCTION AND WELL TESTING RESULTS

Well Designation	Completed Date	Northing	Easting	Elevation Top of PVC Feet msl	Elevation Concrete Pad Feet)	Top of Screen	Bottom of Screen	Hydraulic Conductivity (ft/day)	Unit Monitored	Lithology Screened Interval
KM-7	09/26/91	372113.189	658578.407	6001.63	5999.90	46.2	56.2	na	Qb5/I4	vesicular basalt and cinders
KM-10	10/12/91	373073.856	659761.715	6029.43	6027.90	100	120	na	Qb3	basalt
KM-6	09/24/91	371736.929	658601.626	5988.13	5986.00	34.7	44.7	340	Qb5	vesicular basalt
KM-2	09/21/91	371777.028	660379.196	6025.11	6023.00	47.2	57.2	266	Qb5	basalt, clay
KM-1	10/07/91	373073.394	659740.078	6029.72	6027.50	45.9	55.9	204	I4	clay, tuff
KM-4	10/02/91	372033.826	659695.190	6023.44	6021.90	43.7	53.7	153	I4	cinders, tuff
KM-15	09/24/92	370332.04	657491.89	5958.10	5956.20	45.2	55.2	105	Qb5a/I5	cinders, basalt
KM-16	09/18/92	371058.74	658151.12	5998.97	5997.20	63.3	73.3	97	Qb5	basalt
KM-11	10/29/91	371745.582	659847.119	6013.63	6012.10	80	100	96	Qb3	basalt
KM-3	10/11/91	371745.657	659825.555	6014.28	6012.20	39.1	49.1	91	I4	clay, tuff
KM-9	09/29/91	371770.477	657836.280	5973.56	5971.50	47.5	57.5	48	Qb5	vesicular basalt
KM-5	10/01/91	372710.706	658856.602	6002.72	6001.50	38	48	37	Qb5	vesicular basalt
KM-12	10/29/91	371778.391	658119.553	5976.07	5973.90	134.1	154.1	34	Qb3	basalt
KM-13	10/07/91	372185.749	658042.505	5977.65	5975.60	46.4	56.4	17	Qb5	basalt
KM-19	10/15/92	371788.11	658085.74	5975.17	5973.80	193.6	213.6	15	Qb2/I1	fractured basalt, clay
KM-8	10/21/91	371771.964	658144.161	5976.75	5974.40	34.6	44.6	9.4	Qb5	basalt, clay
KM-18	10/03/92	370336.14	657468.67	5958.25	5956.80	152.6	172.6	8.2	Qb3	basalt
KM-17	09/25/92	371100.35	659365.30	6001.11	5999.60	38.2	48.2	2.3	Qb4/I3	basalt, silt

TABLE 2-1
DATA QUALITY OBJECTIVES
KERR-McGEE CHEMICAL SUPERFUND SITE SODA SPRINGS, IDAHO

Step 1 Problem Statement	**Step 2 Identify the decision**	**Step 2a Alternative Actions (AA)**	**Step 2b Decision Statements**	**Step 3 Inputs to the Decision**	**Step 4 Study Boundaries**	**Step 5 Decision Rule**	**Step 6 Acceptable Limits on Decision Errors**	**Step 7 Optimized Design**

Five Year Review Finding No. 1: Evaluate the likelihood of the remedy achieving cleanup goals within a specifiable timeframe

PS-1: Remedy is not attaining RBC for some COC in ground water 10 years following LSE. Trends for arsenic, manganese, molybdenum and vanadium are flat or upwards at some wells. Assessment of the existing remedy is needed.	PS: Is each source remedy component functioning to control the source as designed and installed, including LSE, S-X pond cover, scrubber pond cover, MAP ponds cover, settling pond covers, west calcine cover, vanadium plant footprint cover, landfill cover, calcine cap cover?	AA-1: No action. As built review and site inspection data indicate the source remedy was installed as designed and components are functioning as designed. AA-2: As built and other available data including ground water data indicate remedy is not performing as intended and additional action is needed.	DS-1: Decide if source remedy components were installed, are functioning as designed and no additional remedy is needed to control the potentially uncontrolled sources. DS-2: Decide if additional actions are needed to assess that source remedy is functioning as designed and installed.	Sources of information to resolve decision statements include: Conceptual Site Model (history of releases, history of site chemical use and operations, land use, receptors, media of concern, points of exposure, exposure routes, fate and transport of COC, climate data) Remedial action design and construction as-built records Post-construction remedy maintenance and operation data Current condition of covers of remediated site facilities RI results and FS models ROD findings and requirements Post-remedy site ground water and surface water monitoring results Monsanto and Evergreen ground water and surface water data COC and site hydro-geochemistry Alternative remedial technologies EPA policy and guidance Ground water levels and precipitation data Use of professional judgment evaluating remedial construction as-builts	***Spatial Boundary*** Location and spatial delineation of source areas identified in RI/FS and ROD. Potential source areas will range in size as determined by a combination of available analytical and/or observational information. The spatial delineation of COC in the vadose zone soil, ground water and surface water Spatial location of existing monitoring wells relative to sources and ground water flow paths ***Vertical Boundary*** Vertical delineation of source areas identified in RI/FS and ROD. Potential source areas will range in depth as determined by available analytical and/or observational information. The vertical delineation of COC in vadose zone, ground water and surface water Relative screen depths of monitoring wells to potential sources and ground water flow paths ***Temporal Boundary*** Historic vadose zone information, ground water and surface water data will be evaluated for quantity, quality, and coverage with time. It is assumed that COC concentrations in the vadose zone does not or has not changed since the time of data collection. Statistical analysis of future COC trends time frame will be within the agreed upon time frames following LSE.	If data indicate that the source remedy was installed and is functioning as designed, then additional actions are not needed; otherwise, additional actions are needed.	Visual inspection of remedy caps and covers on 30 x 30-foot or 50 x 50-foot grid will reduce the error of missing noteworthy features on inspected caps or covers. Data quantity and quality must meet usability criteria to assess temporal and spatial COC trends and to evaluate design effectiveness in order to reduce an error. For analytical data, the precision, accuracy, representativeness, comparability, and completeness criteria and the minimum detection limits will be used to evaluate the usability of analytical data in making decisions about the remedy and potential source areas from site related activities. Data must meet approved usability criteria as defined in the QAPP.	Conduct an evaluation of available analytical data, as-builts, and/or other applicable site data such as field reconnaissance survey data. Evaluate whether data are sufficient to assess if source remedy components are functioning to control the sources as designed and installed. If data are not sufficient, then take additional action, including additional site characterization of sources, potentially impacted media, and assess if source remedy is adequately controlling the source and is functioning as designed. If existing and/or new data indicate that the remedy is not adequately controlling the source (not functioning as designed), perform remedial design and take corrective action, as necessary.
PS-2: In recent years, increasing COC in some of the wells downgradient of the former S-X and scrubber ponds suggest that sources not identified or characterized in the RI/FS may be present. Assessment of other potential sources is needed.	PS: Are other unidentified, unmitigated, potentially uncontrolled sources present that are contributing to the failure of the current remedy to meet RBC?	AA-1: No action. Available site data are sufficient to establish that no other contributing sources are present. AA-2: Available site data are insufficient or indicate that other contributing sources are present that were not addressed by the current remedy and additional actions are needed.	DS-1: Decide that other contributing sources are not present. DS-2: Decide that other contributing sources may be present and what additional actions may be required to identify, characterize, and mitigate the other potential contributing sources.	Sources of information to resolve decision statements include: Conceptual Site Model (history of releases, history of site chemical use and operations, land use, receptors, media of concern, points of exposure, exposure routes, fate and transport of COC, climate data) Remedial action design and construction as-built records Post-construction remedy maintenance and operation data Current condition of covers of remediated site facilities RI results and FS models ROD findings and requirements Post remedy site ground water and surface water monitoring results Monsanto and Evergreen ground	***Spatial Boundary*** Location and spatial delineation of known sources and suspected potential source areas related to site activities. The potential source areas will range in size as determined by a combination of available analytical and/or observational information. The spatial delineation of COC in the vadose zone soil, ground water and surface water Spatial location of existing monitoring wells relative to sources and ground water flow paths. ***Vertical Boundary*** Vertical delineation of known and suspected potential source areas related to site activities. The potential source areas will range in depth as determined by a combination of available analytical and/or observational information. The vertical delineation of COC specified in the ROD in vadose zone, ground water, and surface water Relative screen depths of monitoring wells relative to potential sources and ground water	If available data indicate the presence of other potential contributing source areas, then evaluation of additional actions are needed.	Visual inspection the property, spatial and temporal trend analysis Data quality and quantity must be sufficient to assess temporal and spatial trends in COC or to evaluate the potential presence of other sources. For analytical data, the precision, accuracy, representativeness, comparability, and completeness criteria and the minimum detection limits will be used to evaluate the usability of analytical data in making decisions about the remedy and potential source areas from site related activities. Data must meet approved usability criteria as defined in the QAPP.	Conduct evaluation of available analytical data and other applicable site data, field reconnaissance, survey data, to assess if unidentified, unmitigated, potentially contributing sources are contributing COC to ground water. If data are not sufficient, then take additional action, including additional site characterization of other potential sources that may be impacting the current remedy. If existing and/or new data indicate that other unidentified, unmitigated, potentially contributing sources are present and may be contributing to the failure of the current remedy to meet RBC in a reasonable time period, take additional action including remedial design and corrective action, as necessary.

TABLE 2-1
DATA QUALITY OBJECTIVES
KERR-McGEE CHEMICAL SUPERFUND SITE SODA SPRINGS, IDAHO

Step 1 Problem Statement	Step 2 Identify the decision	Step 2a Alternative Actions (AA)	Step 2b Decision Statements	Step 3 Inputs to the Decision	Step 4 Study Boundaries	Step 5 Decision Rule	Step 6 Acceptable Limits on Decision Errors	Step 7 Optimized Design
				water and surface water data COC and ground water geochemistry Alternative remedial technologies EPA policy and guidance Ground water levels and precipitation data Use of professional judgment evaluating remedial construction as-builts Location and delineation of suspected potential source areas not addressed by RI/FS Known condition and physical properties of suspected potential sources not addressed by RI/FS Trend Analysis	flow paths. ***Temporal Boundary*** Historic vadose zone information, ground water and surface water data will be evaluated for quantity, quality, and coverage with time. It is assumed that COC concentrations in the vadose zone does not or has not changed since the time of data collection. Statistical analysis of future COC trends time frame will be within the agreed upon time frames following LSE.			
PS-3: There is some uncertainty that RBC can be reached with the currently implemented remedy. Assessment of the original assumptions made for the remedy and current site conditions is needed.	PS: Were the original assumptions made for the remedy appropriate with respect to the period of time required to achieve RBC?	AA-1: No action because the original assumptions were appropriate. AA-2: The original assumptions used to predict the period of time required to achieve RBC were not appropriate and need to be revised.	DS-1: Decide whether existing data support the estimate of clean up time. DS-2: Decide if an alternative period of time to achieve RBC is acceptable.	Sources of information to resolve decision statements include: Conceptual Site Model (history of releases, history of site chemical use and operations, land use, receptors, media of concern, points of exposure, exposure routes, fate and transport of COC, climate data Location and delineation of known and suspected potential solid source areas Known condition and physical properties of suspected and known sources RI results and FS models Site ground water and surface water monitoring results Spatial trend analysis COC and ground water geochemistry Preferential flow paths Monsanto and Evergreen ground water data Screening benchmarks (risk based/background) for COC EPA policy and guidance Potential receptors Existing institutional controls	***Spatial Boundary*** Location and spatial delineation of known sources and suspected potential source areas related to site activities The spatial delineation of COC in the vadose zone soil, ground water and surface water Hydrogeologic boundaries Ground water flow paths ***Vertical Boundary*** Vertical delineation of known and suspected potential source areas related to site activities The vertical delineation of COC specified in the ROD in vadose zone, ground water, and surface water Ground water flow paths ***Temporal Boundary*** Historic vadose zone information, ground water and surface water data will be evaluated for quantity, quality, and coverage with time. It is assumed that COC concentrations in the vadose zone does not or has not changed since the time of data collection. Statistical analysis of future COC trends time frame will be within the agreed upon time frames following LSE.	If the original assumptions in the RI/FS with respect to the period of time required to achieve RBC are no longer valid, then decide if an alternative period of time is acceptable.	Data quality and quantity must be sufficient to assess temporal and spatial trends in COC or to evaluate the potential presence of uncontrolled sources. For analytical data, the precision, accuracy, representativeness, comparability, and completeness criteria and the minimum detection limits will be used to evaluate the usability of analytical data in making decisions about the remedy and potential source areas from site related activities. Data must meet approved usability criteria as defined in the QAPP.	Conduct an evaluation of available analytical data and applicable site data to assess if and when COC will achieve RBC. Assess if estimated times to achieve RBC is reasonable. Ensure approved protective institutional controls are in place and enforceable until RBC are achieved. If data are not sufficient, collect additional samples and information to assess if an alternative time frame is reasonable.

TABLE 2-1
DATA QUALITY OBJECTIVES
KERR-McGEE CHEMICAL SUPERFUND SITE SODA SPRINGS, IDAHO

Step 1 Problem Statement	Step 2 Identify the decision	Step 2a Alternative Actions (AA)	Step 2b Decision Statements	Step 3 Inputs to the Decision	Step 4 Study Boundaries	Step 5 Decision Rule	Step 6 Acceptable Limits on Decision Errors	Step 7 Optimized Design
Five Year Review Finding No. 2: Evaluate adequacy of current groundwater monitoring network for identifying the off-site migration of COC								
PS-1: The ground water monitoring network may be inadequate to identify flow paths from the site or to define the offsite extent of ground water COC exceeding the RBC.	PS-1: Does the current monitoring well network adequately define the migration of COC from the site?	AA-1: No action because analytical and site data indicate the monitoring well network adequately defines the migration of COC from the site. AA-2: Analytical and data indicate the monitoring well network does not adequately define the migration of COC from the site and additional coverage is needed.	DS-1: Decide if the monitoring well network adequately defines the migration of COC from the site. DS-2: Decide if additional coverage is needed to adequately define the migration of COC from the site.	Sources of information to resolve decision statements include: Location of existing monitoring wells relative to known and suspected sources and contributing hydrogeologic features including ground water flow paths and boundaries. Stratagraphic controls on ground water flow Spatial trend analysis Conceptual Site Model (history of releases, history of site chemical use and operations, land use, receptors, media of concern, points of exposure, exposure routes, fate and transport of COC, climate data Location and delineation of known and suspected potential source areas Known condition and physical properties of suspected and known sources. RI results and FS models Site ground water and surface water monitoring results. Spatial trend analysis. COC and site hydro-geochemistry. Preferential flow paths Monsanto and Evergreen ground water data Screening benchmarks (risk based/background) for COC EPA policy and guidance	***Spatial Boundary*** Location and spatial delineation of known sources and suspected potential source areas related to site activities The spatial delineation of COC in the vadose zone soil, ground water and surface water Locations of potential off-site receptors Hydrogeologic boundaries Extent and location of preferential flow paths ***Vertical Boundary*** Vertical delineation of known and suspected potential source areas related to site activities The vertical delineation of COC in vadose zone, ground water, and surface water Extent and location of preferential flow paths with depth ***Temporal Boundary*** Historic vadose zone information, ground water and surface water data will be evaluated for quantity, quality, and coverage with time. It is assumed that COC concentrations in the vadose zone does not or has not changed since the time of data collection. Statistical analysis of future COC trends time frame will be within the agreed upon time frames following LSE.	If existing data (including MAROS results) indicate that the existing coverage does not adequately define the migration of COC from the site, then additional wells will be installed to modify existing coverage. If existing data (including MAROS results) indicate that the existing coverage adequately defines migration of COC from the site, then the existing well network will be considered adequate.	Spatial and temporal trend analyses of COC Data quality and quantity must be sufficient to assess temporal and spatial hydrogeologic factors to evaluate the potential for an alternate period of time to achieve RBC MAROS evaluation should have sufficient sensitivity to provide reliable estimates of downgradient concentrations	Conduct an evaluation of available analytical and hydrogeologic data and other applicable site data to evaluate whether additional ground water monitoring coverage is needed. If additional coverage is needed prepare work plan to complete coverage. Minimize total number of well installations.

TABLE 3-1
ESTIMATED MASS
OF VANADIUM RELEASED TO GROUND WATER THROUGH 1993

Pond/Source Area	Dates From	Dates To	Total Years	Percent of Total Discharge
SX Pond	1968	1989	21	0.40
SX Pond	1990	1993	3	0.05
Total SX Pond				0.45
Scrubber Pond	1972	1989	17	0.11
Scrubber Pond	1990	1993	3	0.03
Total Scrubber Pond				0.14
Calcine Pond	1972	1989	17	0.20
Calcine Pond	1990	1993	3	0.06
Total Calcine Pond				0.25
Historic Calcine Pond	1963	1973	10	0.11
Historic MAP Ponds	1973	1993	20	<0.01
Roaster Reject	1986	1993	7	<0.01
Active Calcine Solid	1972	1993	21	0.02
Buried Calcine Solid	1963	1993	30	<0.01
Active Scrubber Solid	1972	1993	21	<0.01
Historic Scrubber Solid	1964	1972	8	0.02
Buried Scrubber Solids	1972	1993	21	<0.01

TABLE 3-2
MONITOR WELL TREND EVALUATION TABLE

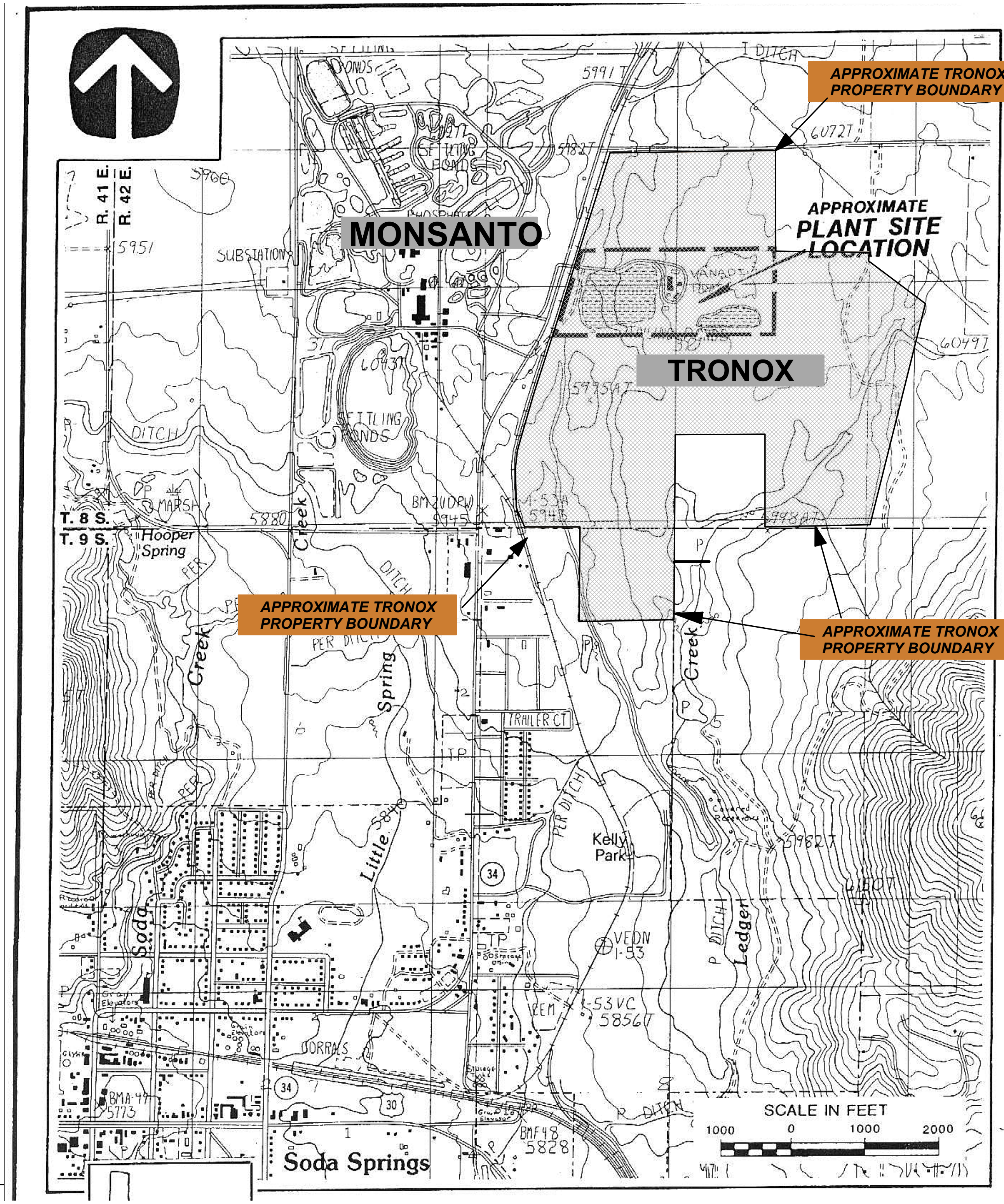
Well ID	Well Use	Total Well Depth	COC Exceeding RBC	As Increasing or Decreasing?	Mn Increasing or Decreasing?	Mo Increasing or Decreasing?	V Increasing or Decreasing?	ROD Clean-up Achieved?	Source Area Monitored
KM-1	Shallow Background	55.9	NA	Not Sampled	Not Sampled	Not Sampled	Not Sampled	NA	Lateral gradient background well - not sampled
KM-2	POC Well	57.2	As, Mo, V	No Trend	Decreasing	Decreasing	Decreasing	No	Active calcine tailing impoundment/former scrubber pond area
KM-3	POC Well	49.1	As, Mn, Mo, V	No Trend	Increasing since 2001	Flat since 2001	No trend	No	Reclaimed scrubber pond
KM-4	Internal Facility Monitoring	53.7	As, Mo, V	No Trend	No trend	Decreasing	No trend	No	Active calcine tailing impoundment area
KM-5	POC Well	48	V	Less than detection	No Trend	Flat/slightly decreasing	Flat since 2002	No	Historic scrubber pond/historic MAP ponds, Boiler blowdown pond/downgradient of facility
KM-6	Edge of Facility Monitoring	44.7	As, Mo, V	Less than detection	No trend/rising since 2002	Flat/slightly increasing since 2002	Increasing since 2004	No	Historic Limestone Settling Ponds/Zone of large transmissivity
KM-7	Internal Facility Monitoring	56.2		Less than detection	Decreasing	Decreasing	Flattening since 2002	No	Historic calcine impoundment area
KM-8	POC Well	44.6	As, Mn, Mo, V	No Trend	Increasing since 2004	Increasing since 2006	No trend	No	Former S-X pond/ downgradient of plant facility
KM-9	POC Well	57.5	V	Less than detection	No Trend	Flattening/slightly decreasing	Decreasing	No	Former S-X pond/downgradient of plant facility
KM-10	Intermediate Depth Background	120	NA	Not Sampled	Not Sampled	Not Sampled	Not Sampled	NA	Intermediate depth background well

TABLE 3-2
MONITOR WELL TREND EVALUATION TABLE

Well ID	Well Use	Total Well Depth	COC Exceeding RBC	As Increasing or Decreasing?	Mn Increasing or Decreasing?	Mo Increasing or Decreasing?	V Increasing or Decreasing?	ROD Clean-up Achieved?	Source Area Monitored
KM-11	Intermediate Depth POC Well	100	Mo	Less than detection	No trend	Decreasing	Decreasing	No	Former scrubber pond
KM-12	Intermediate Depth POC Well	154.1	Mo, V	Less than detection	No Trend	Decreasing	Decreasing	No	Former S-X pond/ downgradient of plant facility
KM-13	POC Well	56.4	Mo, V	Less than detection	No Trend	Decreasing	Decreasing	No	Former S-X pond (north end) and downgradient of plant facility
KM-15	Off-Site Well	55.2	Mo, V	Less than detection	Decreasing	Decreasing	Decreasing/flattening in 2004	No	Off-site well southwest of former S-X pond and within main area of impacted ground water
KM-16	Off-Site Well	73.3	Mo, V	Less than detection	Decreasing	Flattening since 2003	Increasing since 2006	No	Off-site well south of former S-X and settling ponds and within main area of impacted ground water
KM-17	Off-Site Well	48.2	Mo	Less than detection	No Trend	Decreasing	At detection	No	Off-site well southwest of former scrubber pond and active calcine tailing
KM-18	Intermediate Depth Off-Site Well	172.6	Mo, V	Less than detection	Decreasing	Decreasing	Decreasing/flattening in 2004	No	Off-site well southwest of former S-X pond, pond and within main area of impacted ground water, paired with KM-15
KM-19	POC Deep Well	213.6	None	Less than detection	Decreasing	Flat	Flat	Yes	Former S-X pond and downgradient of plant facility

TABLE 3-3
CHRONOLOGY OF PROCESS CHANGES
SINCE COMPLETION OF RI/FS

Event	Date(s)	Comments
Fertilizer Plant Operational	July 1998 to May 2000	Calcine removed from active calcine Impoundment, processed to fertilizer. Reject fertilizer placed in calcine impoundment.
Discontinue Vanadium Processing – Vanadium Plant Idle	January 1999 to present	Discontinue stockpiling of calcine, discontinue all vanadium process streams to lined ponds, discontinue the recycle of roaster reject.
Cap Active Calcine Impoundment	May 2001 through August 2001	Calcine was capped using multi-component cover to eliminate meteoric infiltration through calcine tailing. Substantial amount of dust control/construction water used.
Dismantle Vanadium Plant	November 2001 through May 2002	Materials removed to approved facility, surface footprint cleaned in preparation for surface regrade. Footprint regraded with limestone fines in April/May 2003
Dismantle Fertilizer Plant	November 2002 through June 2003	Materials removed to approved facility, surface footprint cleaned in preparation for surface regrade.
Reclaim Stormwater Runoff Ponds	September through October 2003	Solids and liquids removed to 10-acre pond, site regraded and reclaimed.
Reclaim 5-Acre Ponds	September through October 2004	Solids and liquids removed to 10-acre pond, east pond site regraded and reclaimed.
Regrade Scrubber Pond Cover	November 2005	Fill and regrade south of calcine cap



ADDENDUM 1 WORK PLAN

APPROXIMATE TRONOX PROPERTY BOUNDARY LOCATION MAP

REFERENCE: U.S.G.S. QUADRANGLE
SODA SPRINGS, IDAHO PROVISIONAL
EDITION 1982.

SEE APPENDIX A FOR LEGAL DESCRIPTIONS

FIGURE 1-1

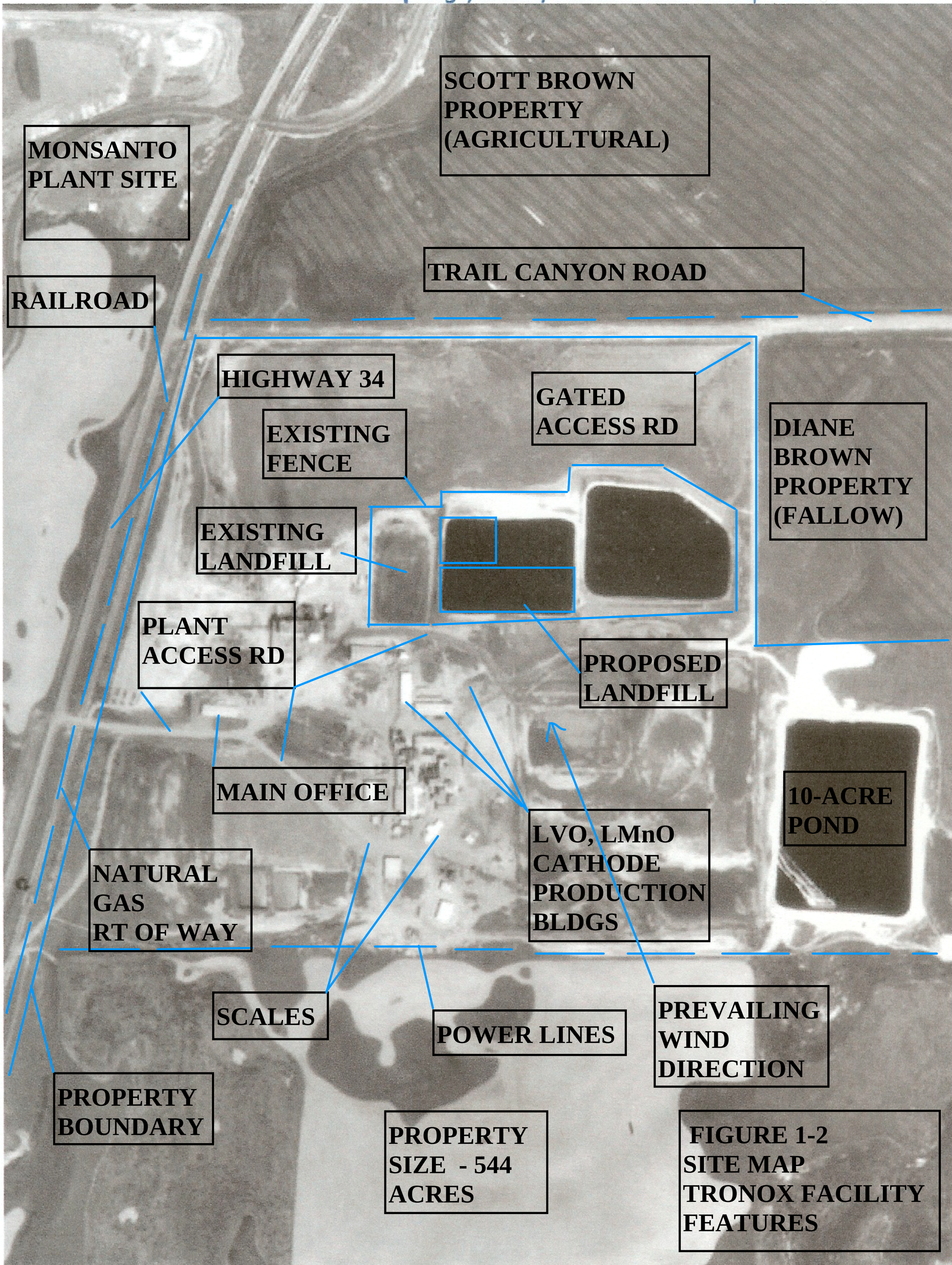
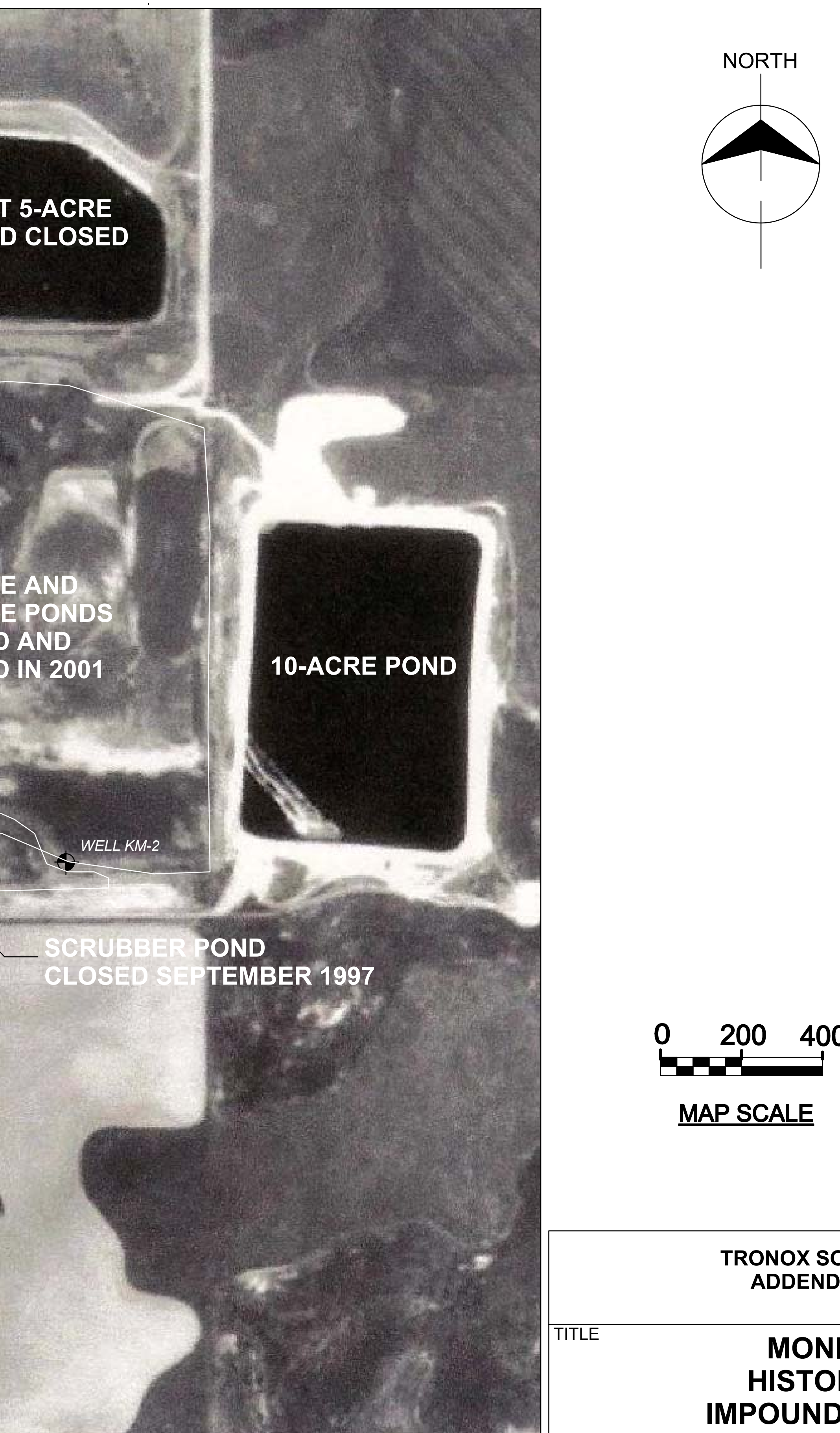


FIGURE 1-2
SITE MAP
TRONOX FACILITY
FEATURES

WELL KM-18
WELL KM-15

REFERENCE: USGS TERRASERVER
DATE OF PHOTOGRAPHY SEPTEMBER 7, 2000

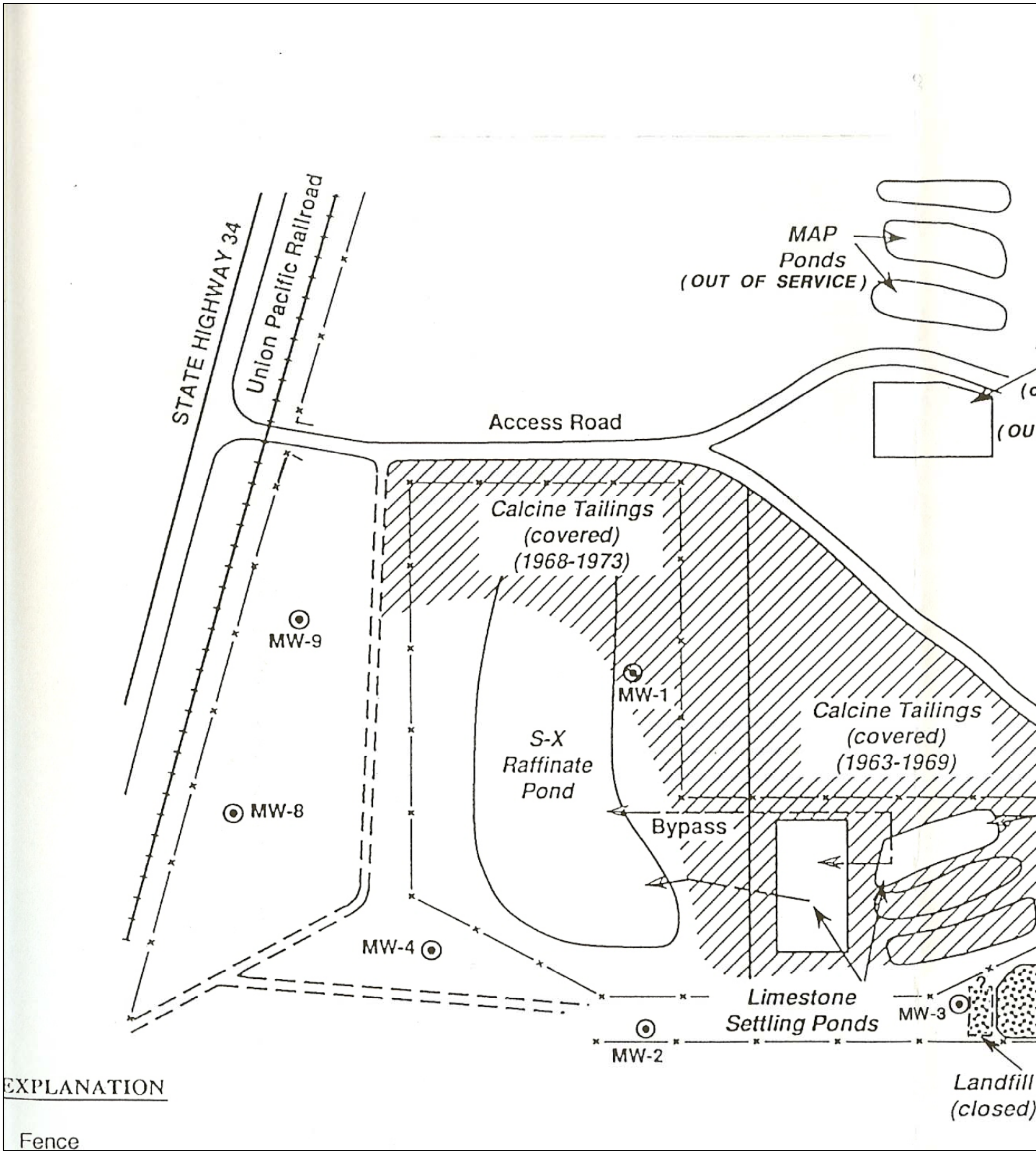


TRONOX SODA SPRINGS, IDAHO
ADDENDUM 1 WORK PLAN

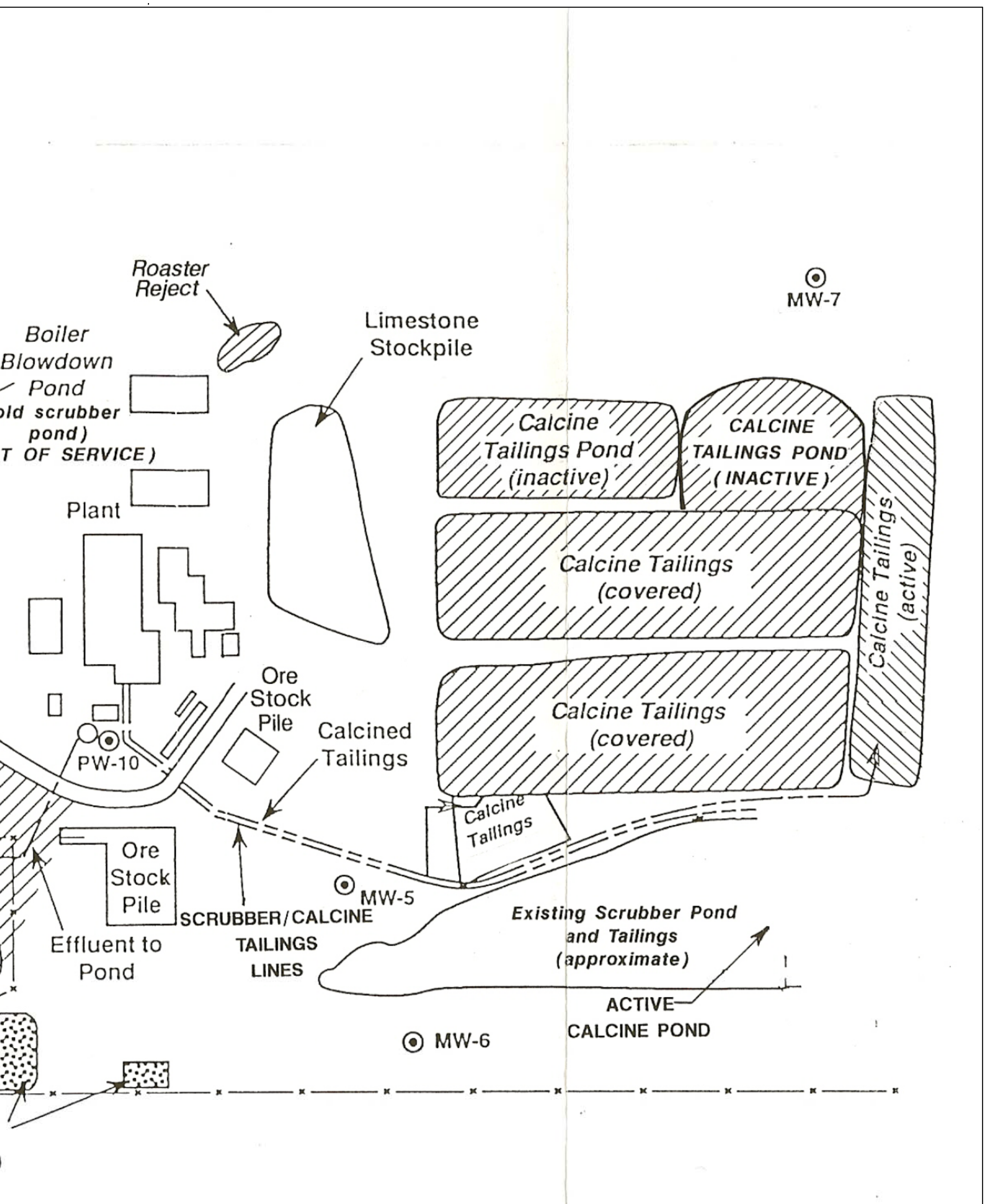
TITLE: **MONITOR WELLS, HISTORIC POND AND IMPOUNDMENT FEATURES**			
SIZE: B	CAGE CODE	DWG NO	REV
SCALE		SHEET: **FIGURE 1-3**	

4/15/08

DRAWN BY J.S. BROWN, P.G.



REFERENCE: DAMES & MOORE, 1995

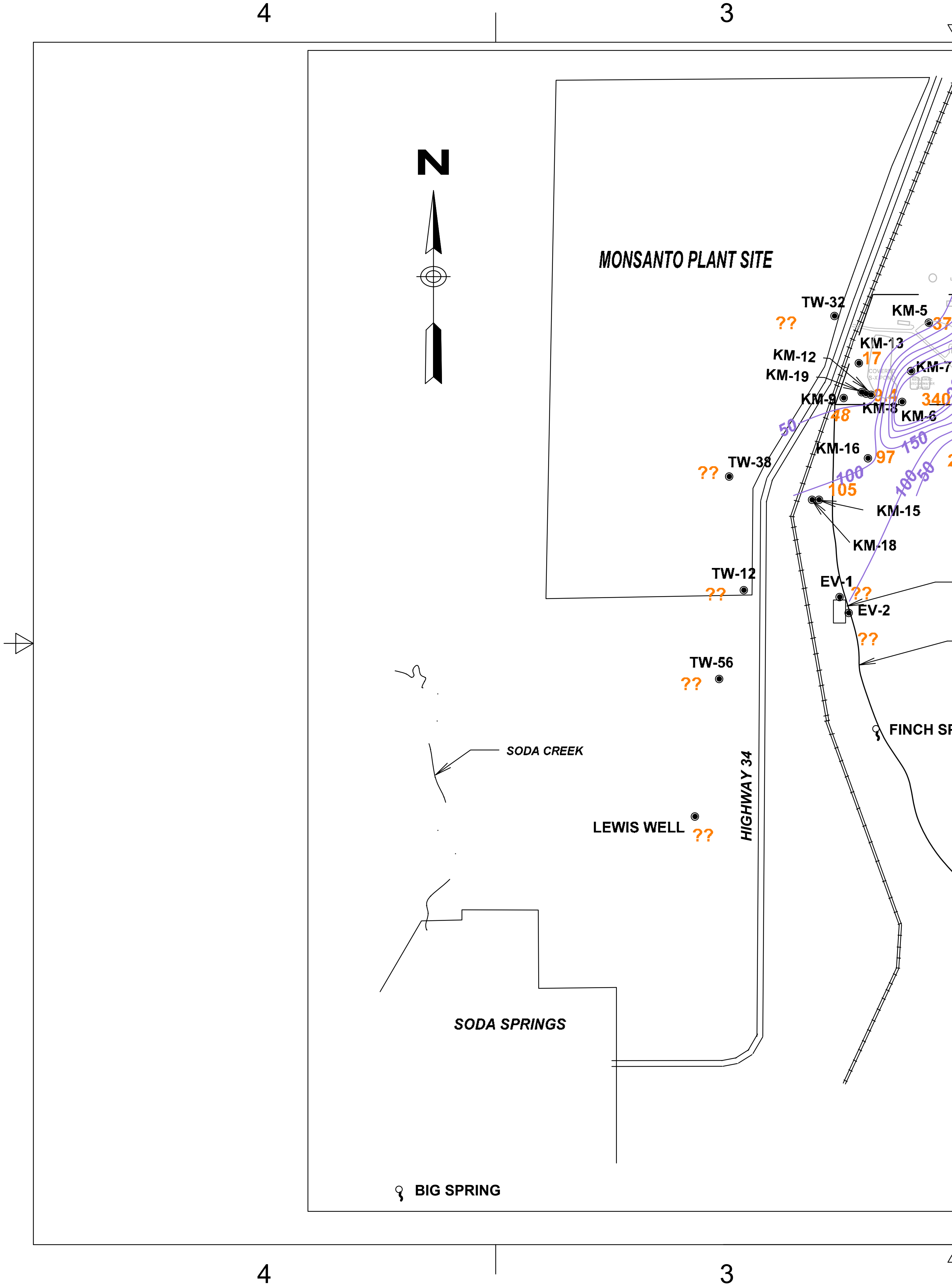


TRONOX SODA SPRINGS IDAHO
ADDENDUM 1 WORK PLAN

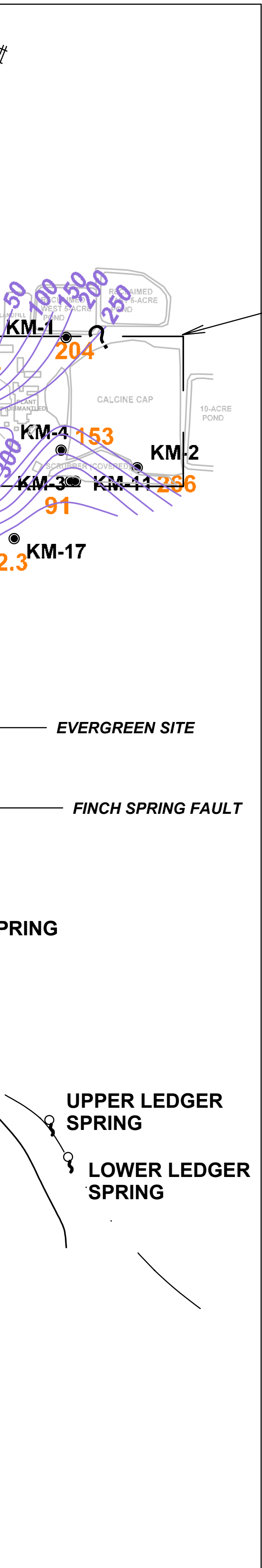
TITLE	**HISTORIC SOLID SOURCES AND IMPOUNDMENTS**		
SIZE B	CAGE CODE	DWG NO	REV
SCALE		SHEET	FIGURE 1-4

4/14/08

DRAWN BY J.S. BROWN, P.G.



4
3
N
MONSANTO PLANT SITE
TW-32
??
KM-5
KM-13
17
KM-12
KM-19
KM-9
KM-8
48
KM-6
340
50
KM-16
97
150
TW-38
??
100
105
KM-15
KM-18
TW-12
??
EV-1
??
EV-2
??
TW-56
??
SODA CREEK
HIGHWAY 34
LEWIS WELL
??
SODA SPRINGS
BIG SPRING
4
3



KEY

200

INFERRED CONTOUR AND HYDRAULIC CONDUCTIVITY ISOPLETH

2.3
KM-17

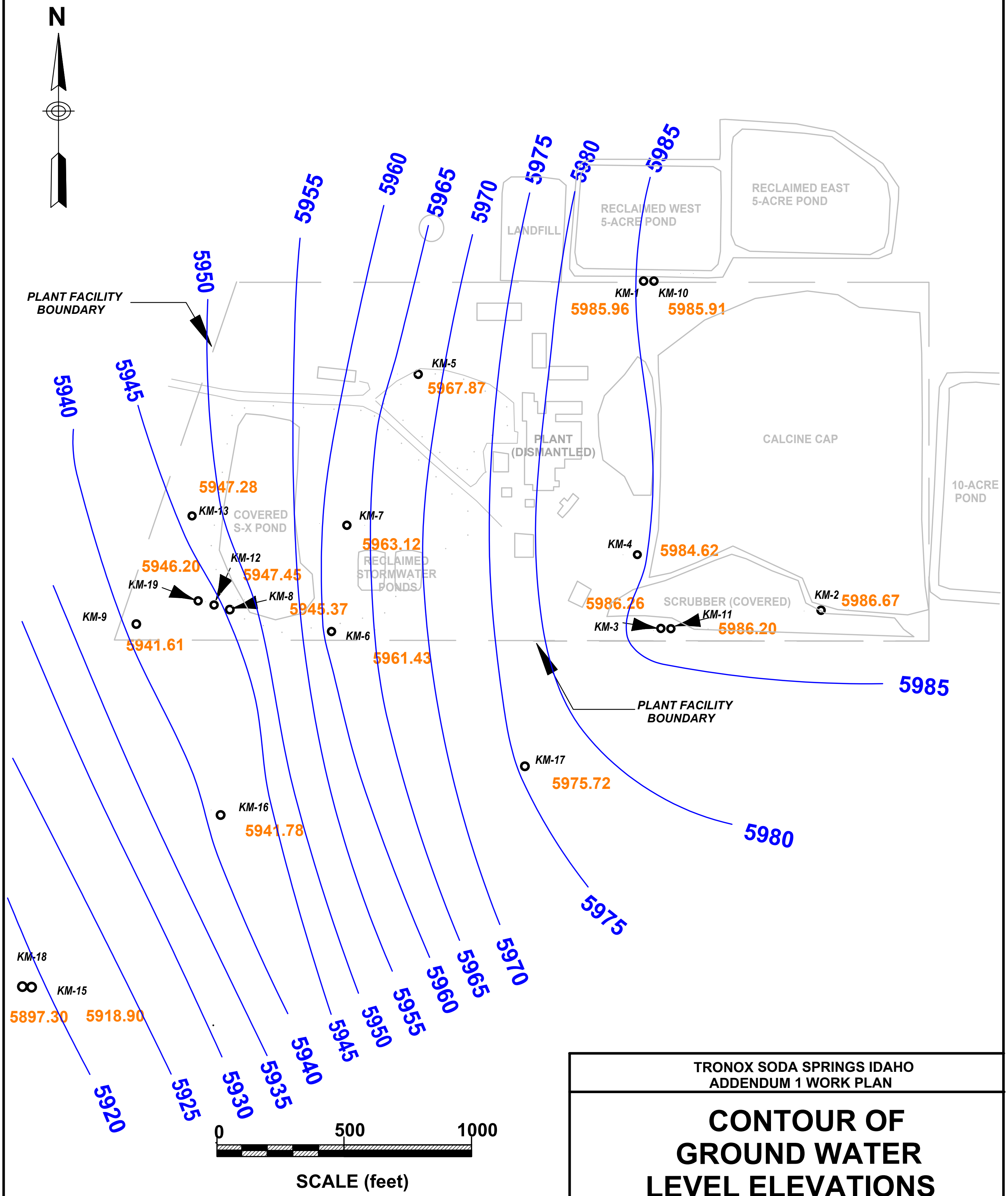
MONITOR WELL LOCATION AND ESTIMATED HYDRAULIC CONDUCTIVITY IN FEET/DAY

SCALE IN FEET

0 750 1500 3000

ADDENDUM 1 WORK PLAN

TITLE DISTRIBUTION OF SHALLOW AQUIFER HYDRAULIC CONDUCTIVIY			
SIZE B	CAGE CODE	DWG NO WATERSAMPLELOCATIONS.TCW	REV 0
SCALE AS SHOWN		SHEET FIGURE 1-5	



NOTE: CONTOURS BASED ON GROUND WATER LEVELS IN SHALLOW WELLS

TRONOX SODA SPRINGS IDAHO
ADDENDUM 1 WORK PLAN

CONTOUR OF GROUND WATER LEVEL ELEVATIONS MAY 2007

TRONOX
SODA SPRINGS, IDAHO

FIGURE 1-6

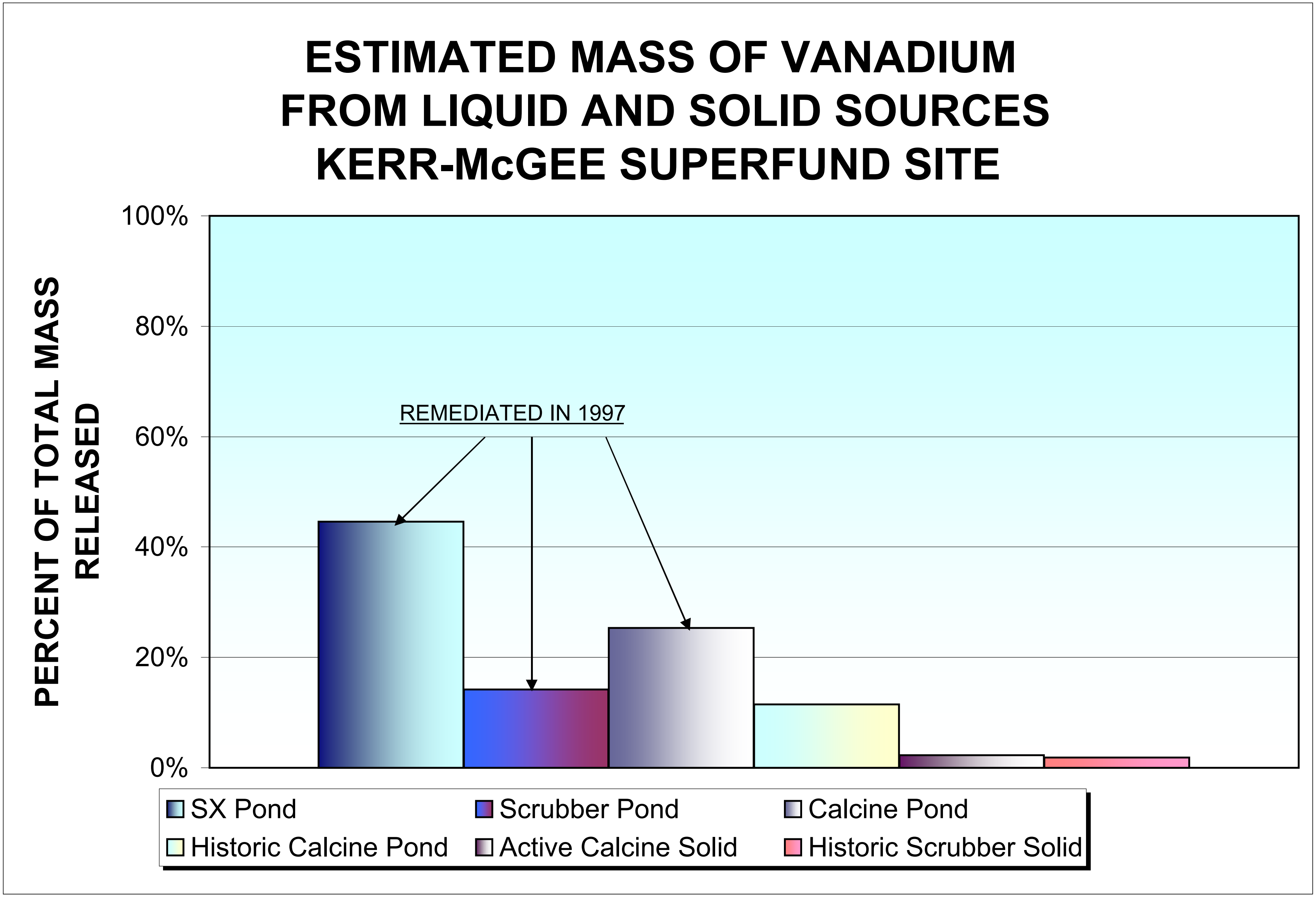
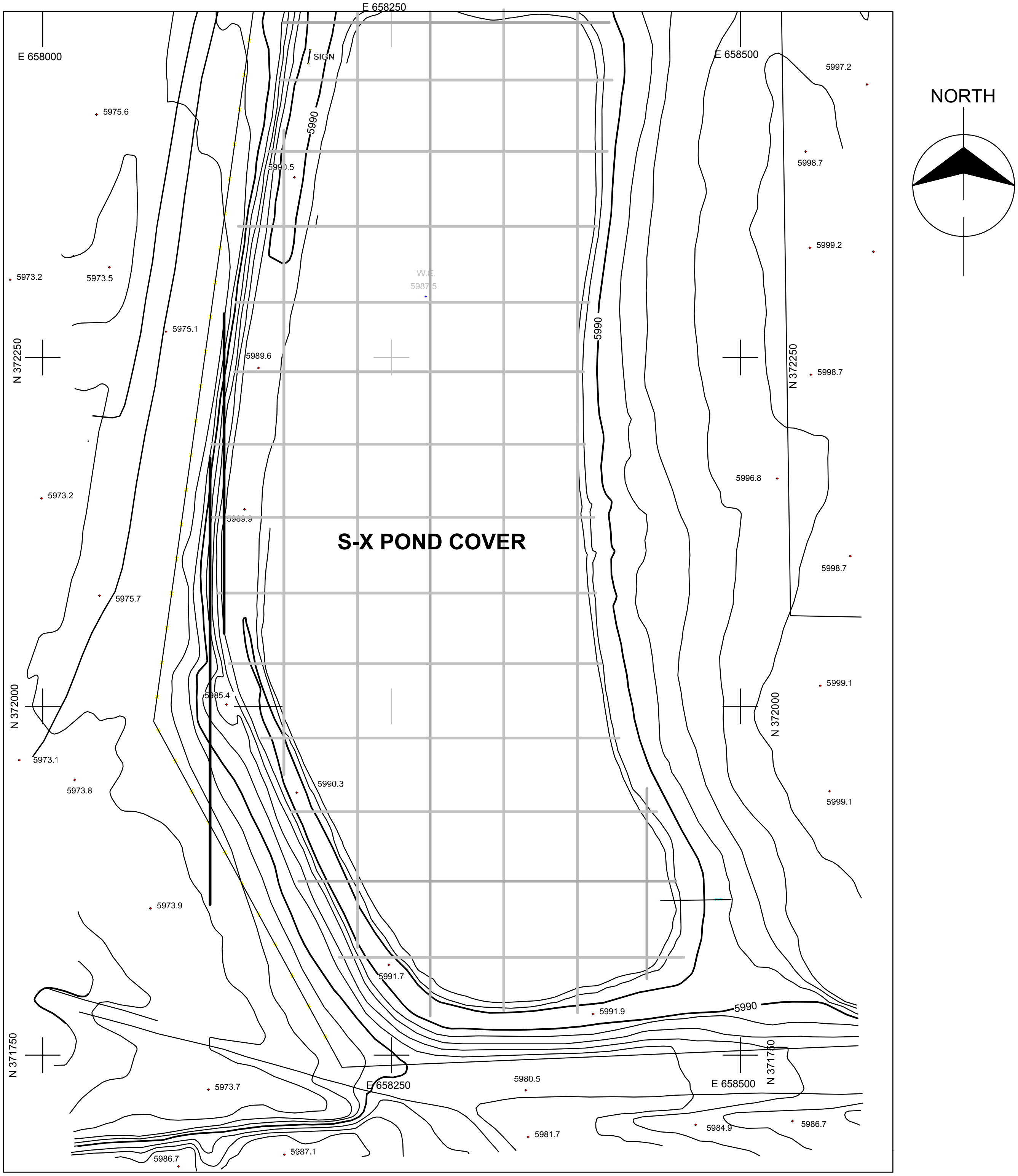

ESTIMATED MASS OF VANADIUM
FROM LIQUID AND SOLID SOURCES
KERR-McGEE SUPERFUND SITE
PERCENT OF TOTAL MASS RELEASED
100%
80%
60%
40%
20%
0%
REMEDIATED IN 1997
SX Pond
Scrubber Pond
Calcine Pond
Historic Calcine Pond
Active Calcine Solid
Historic Scrubber Solid

FIGURE 3-1



TRONOX SODA SPRINGS, IDAHO
ADDENDUM 1 WORK PLAN

S-X POND COVER INSPECTION GRID

50 25 0 50 100 150

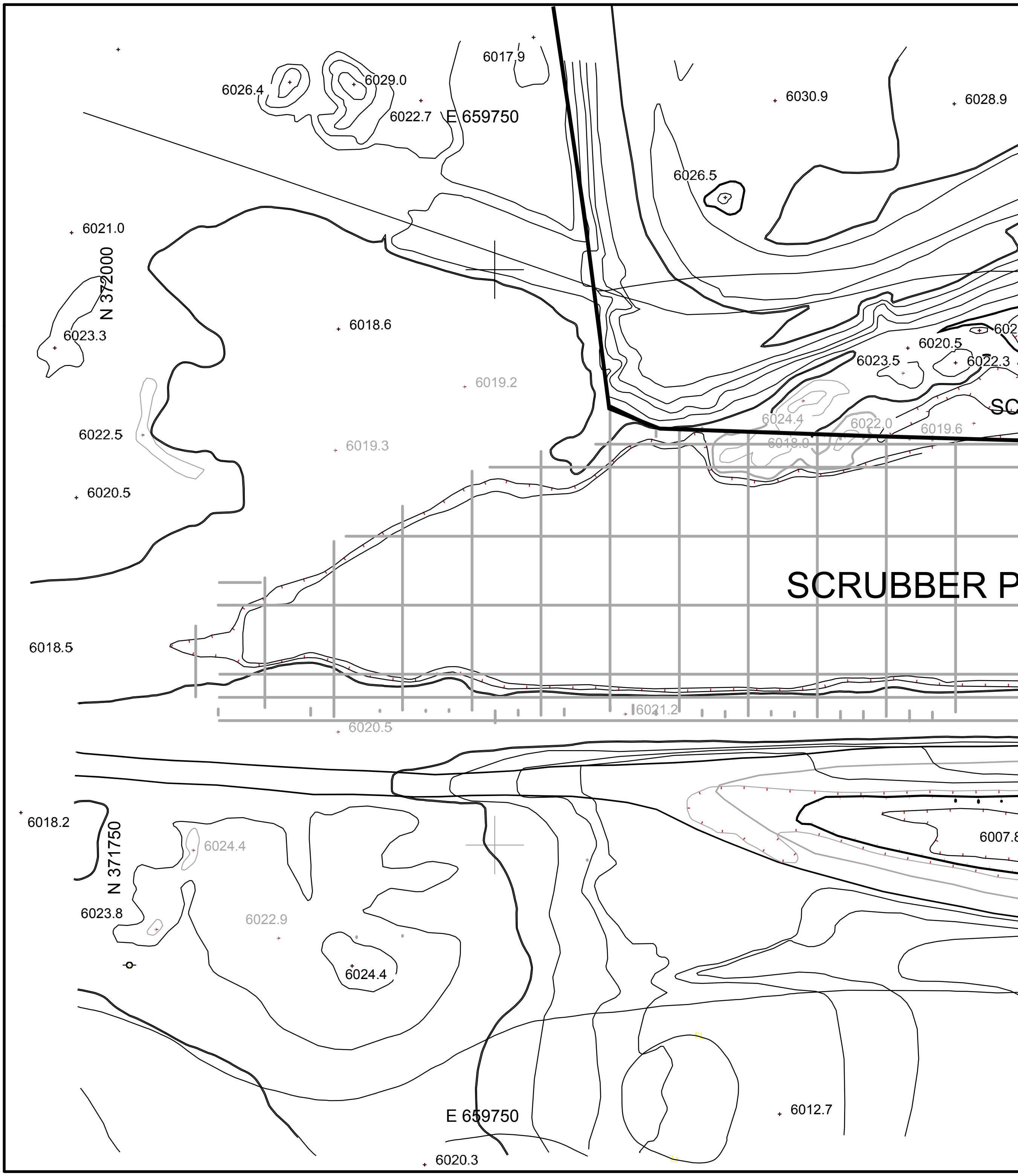
SCALE 1"=50'

CONTOUR INTERVAL 2'

DATE OF PHOTOGRAPHY OCTOBER 10,1991

FIGURE 3-2

4 3



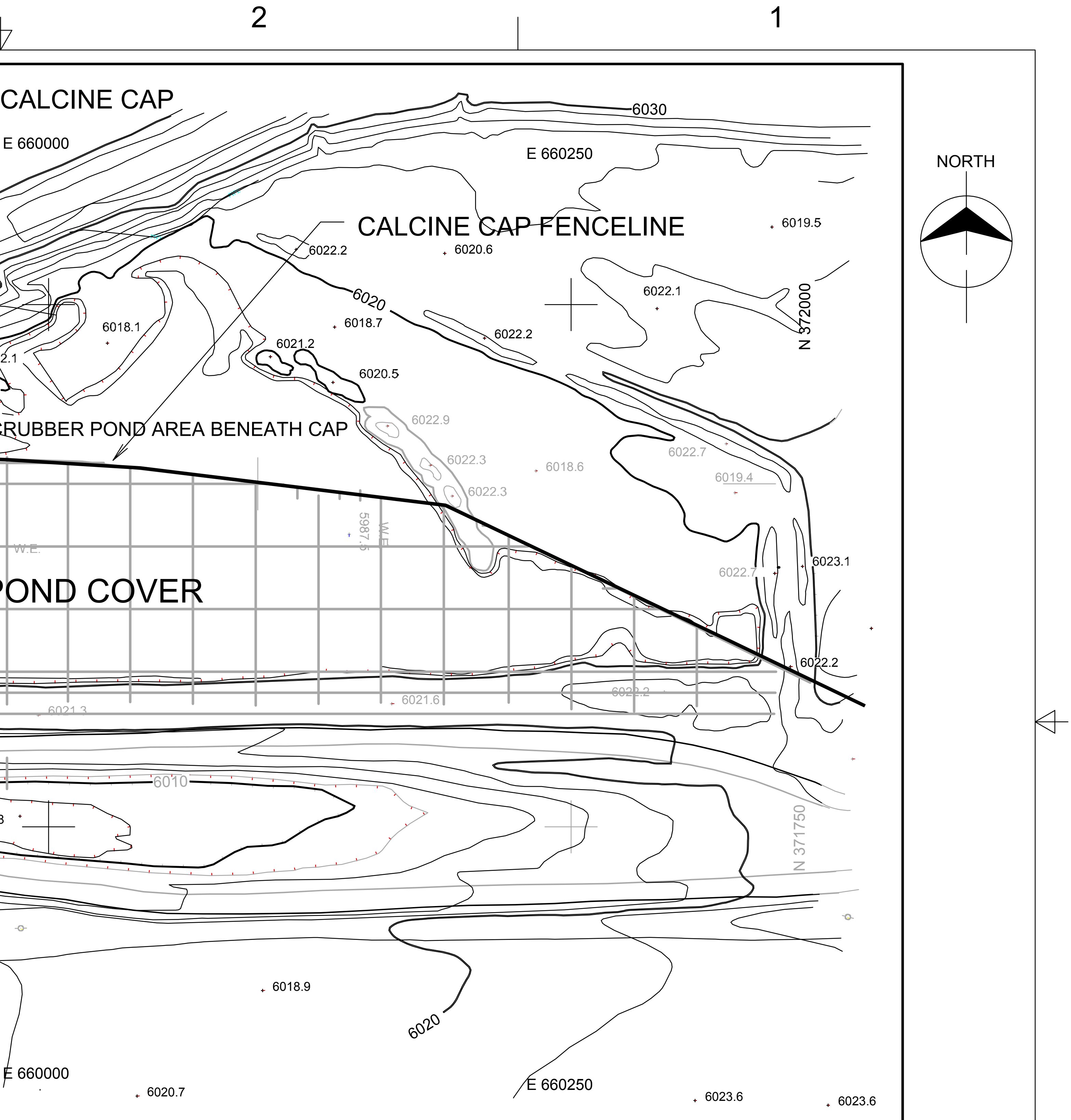
50 25 0 50 100 150

SCALE 1"=50'

CONTOUR INTERVAL 2'

DATE OF PHOTOGRAPHY OCTOBER 10,1991

4 3



TRONOX SODA SPRINGS, IDAHO
ADDENDUM 1 WORK PLAN

TITLE

SCRUBBER POND COVER INSPECTION GRID

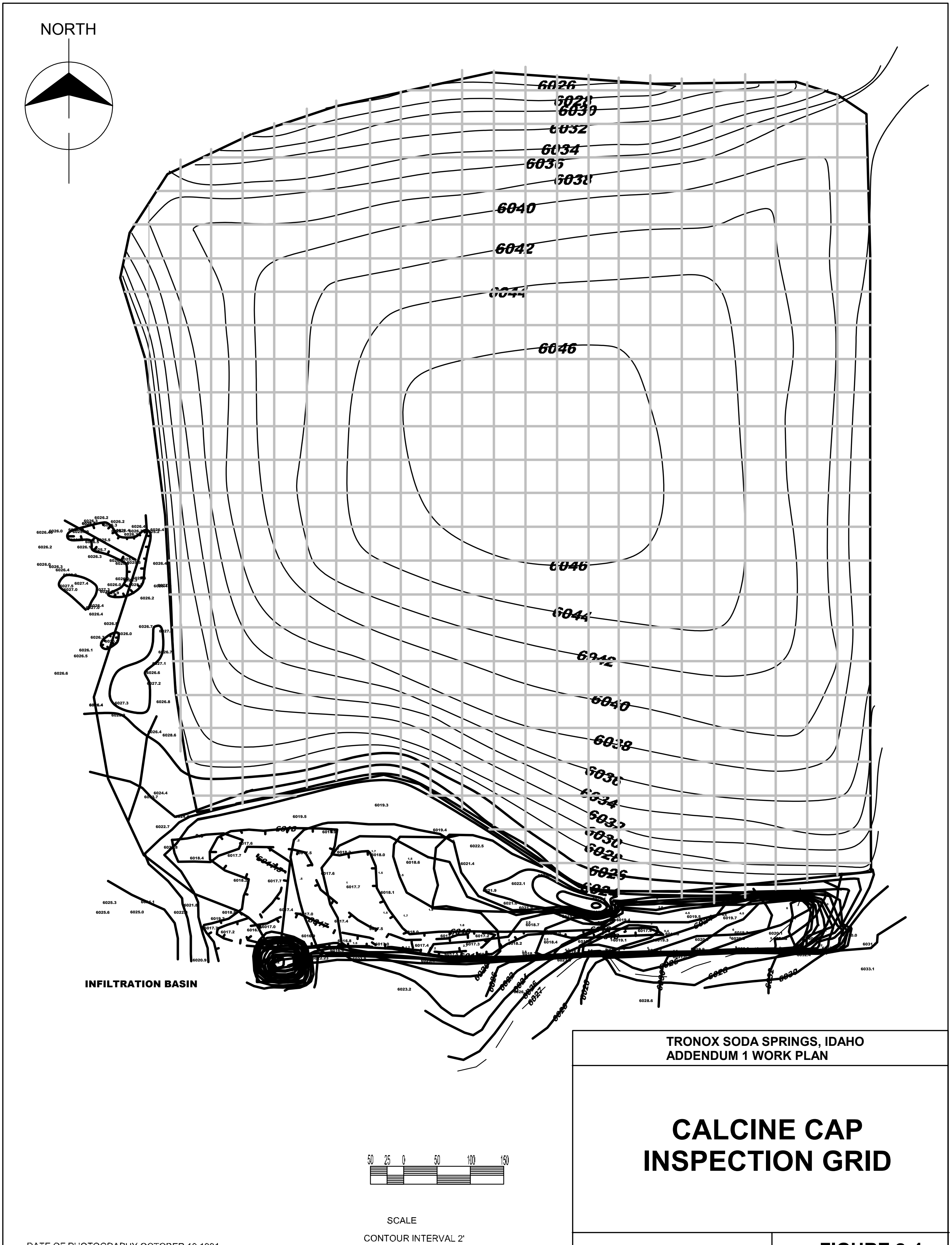
SIZE	CAGE CODE	DWG NO	REV
B			0

DRAWN BY JS BROWN, P.G.

4/15/08

SCALE AS SHOWN

SHEET FIGURE 3-3

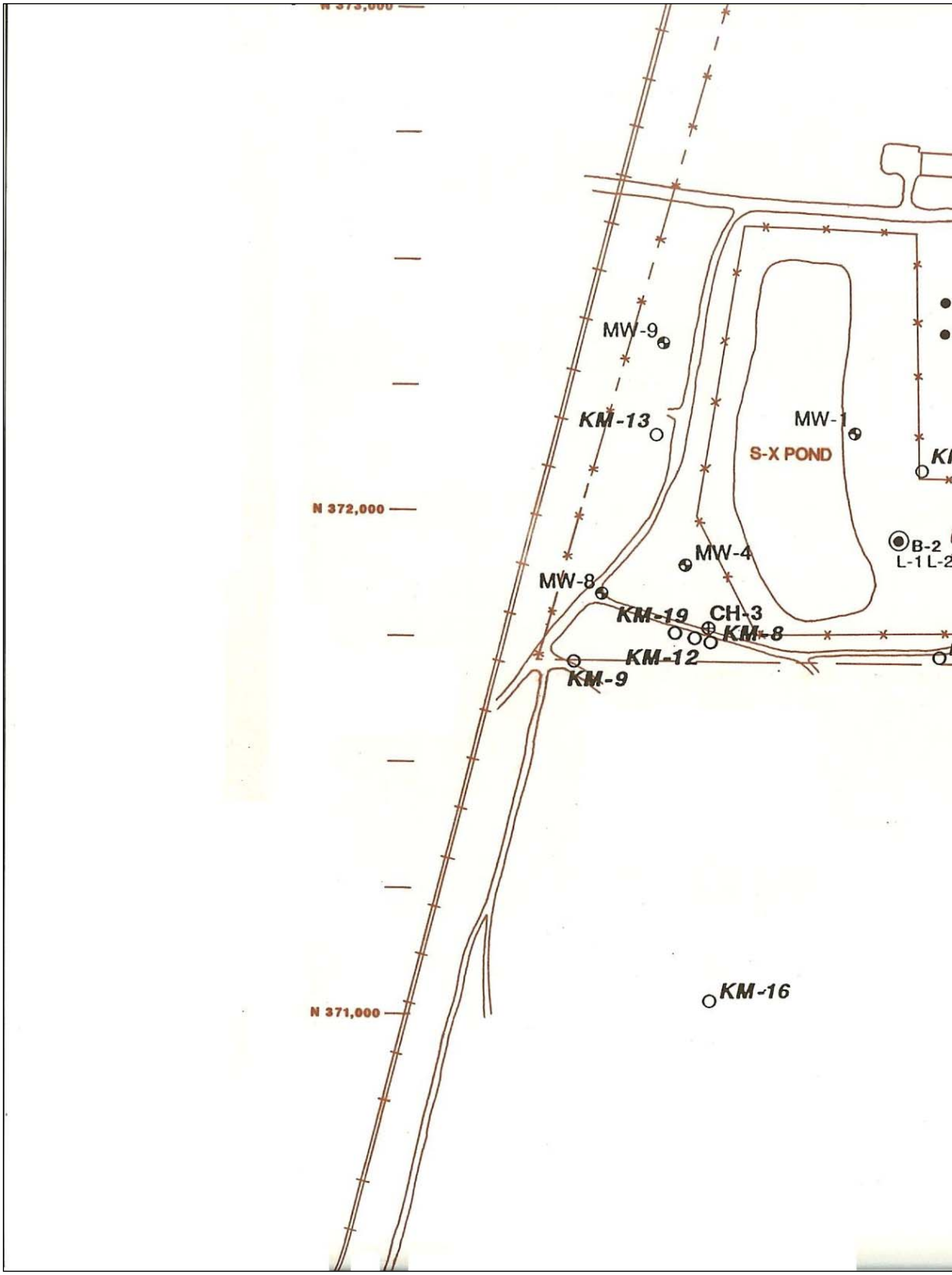


TRONOX SODA SPRINGS, IDAHO
ADDENDUM 1 WORK PLAN

CALCINE CAP INSPECTION GRID

FIGURE 3-4

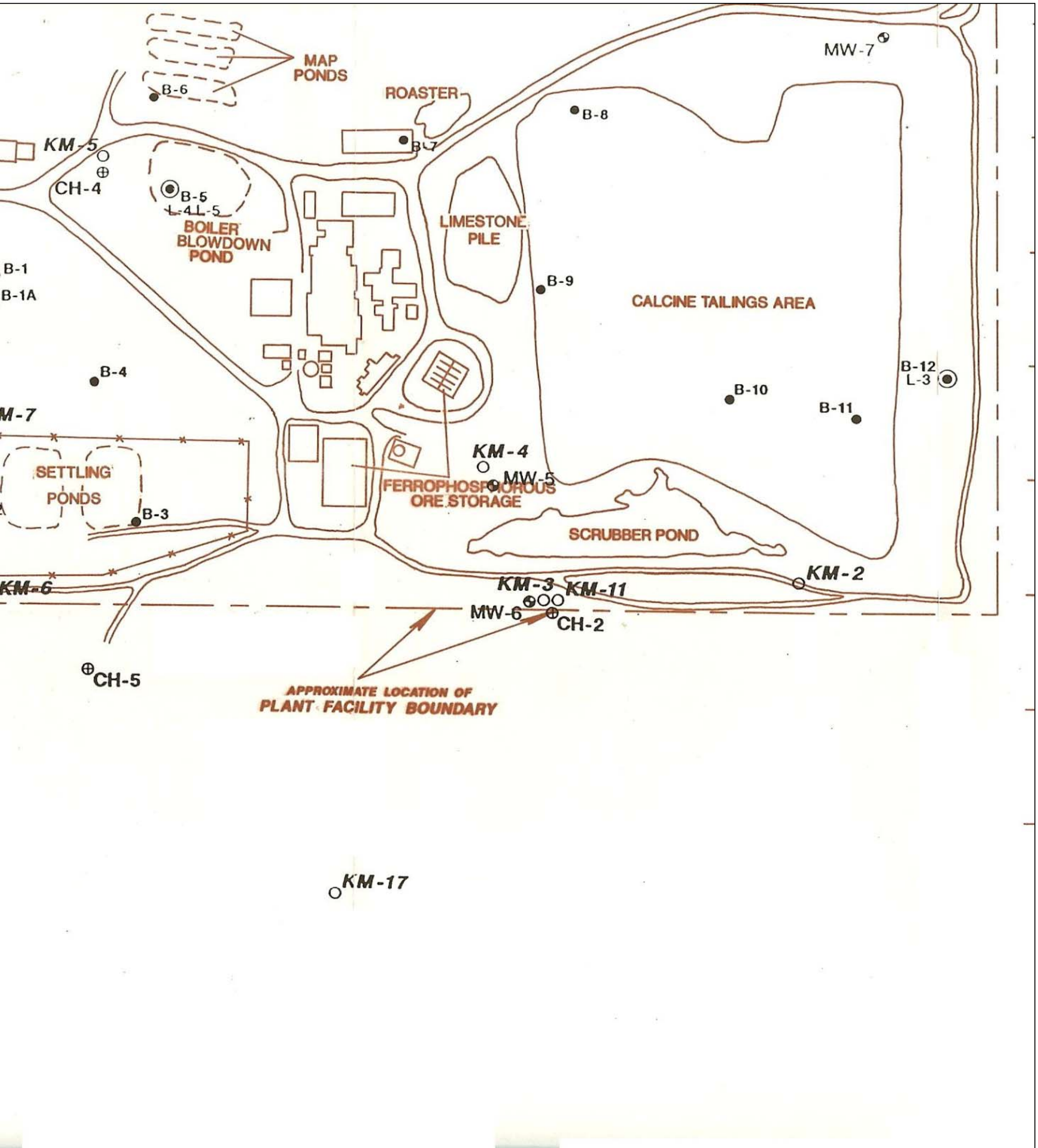
4 3



KM-18 ○○ *KM-15*

REFERENCE: DAMES & MOORE, 1995

4 3



TRONOX SODA SPRINGS IDAHO
ADDENDUM 1 WORK PLAN

TITLE

REMEDIAL INVESTIGATION COREHOLE, BORING, LYSIMETER AND MONITOR WELL LOCATIONS

SIZE	CAGE CODE	DWG NO	REV
B			

4/17/08

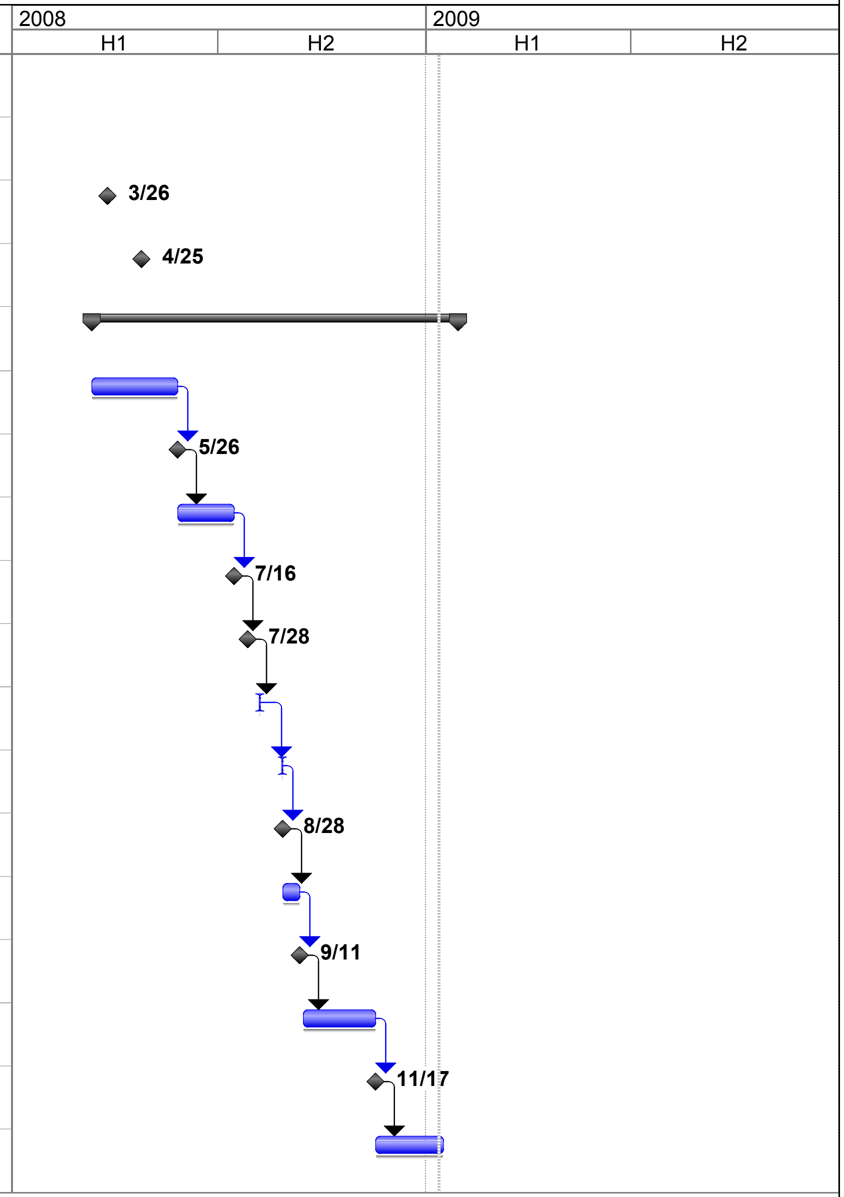
DRAWN BY J.S. BROWN, P.G.

SCALE

SHEET **FIGURE 3-5**

KERR-McGEE CHEMICAL SUPERFUND SITE SODA SPRINGS, IDAHO ADDENDUM 1 TO THE SOW SCHEDULE

ID	Task Name	Start	Finish
1	USACE Inspection	Wed 7/25/07	Wed 7/25/07
2	Second 5-year review	Fri 9/28/07	Fri 9/28/07
3	Report Documenting Arsenic DL Reduction	Wed 3/26/08	Wed 3/26/08
4	USEPA Transmits Addendum 1 to SOW	Fri 4/25/08	Fri 4/25/08
5	**Addendum 1 Work Plan**	**Wed 3/12/08**	**Thu 1/29/09**
6	Prepare Draft Work Plan	Wed 3/12/08	Mon 5/26/08
7	Draft Work Plan Submittal Date	Mon 5/26/08	Mon 5/26/08
8	EPA Review of Draft Work Plan	Tue 5/27/08	Tue 7/15/08
9	EPA Comments to Draft Work Plan	Wed 7/16/08	Wed 7/16/08
10	Tronox Response to EPA Comments	Mon 7/28/08	Mon 7/28/08
11	Comment Response Conference Call	Thu 8/7/08	Thu 8/7/08
12	Comment Response Conference Call	Wed 8/27/08	Wed 8/27/08
13	EPA Transmittal Final Response Work Plan Changes	Thu 8/28/08	Thu 8/28/08
14	Revise Draft Work Plan	Thu 8/28/08	Thu 9/11/08
15	Submit Revised Draft Work Plan	Thu 9/11/08	Thu 9/11/08
16	EPA Review of Revised Draft Final Work Plan	Mon 9/15/08	Mon 11/17/08
17	EPA Comments to Revised Draft Final Work Plan	Mon 11/17/08	Mon 11/17/08
18	Revise Work Plan With DQO	Tue 11/18/08	Fri 1/16/09



Project: ADDENDUM 1 TO RD/RA SC
Date: Mon 1/12/09

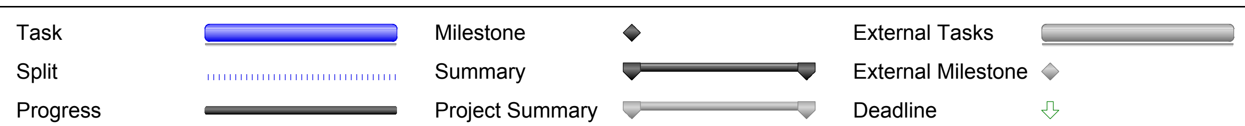
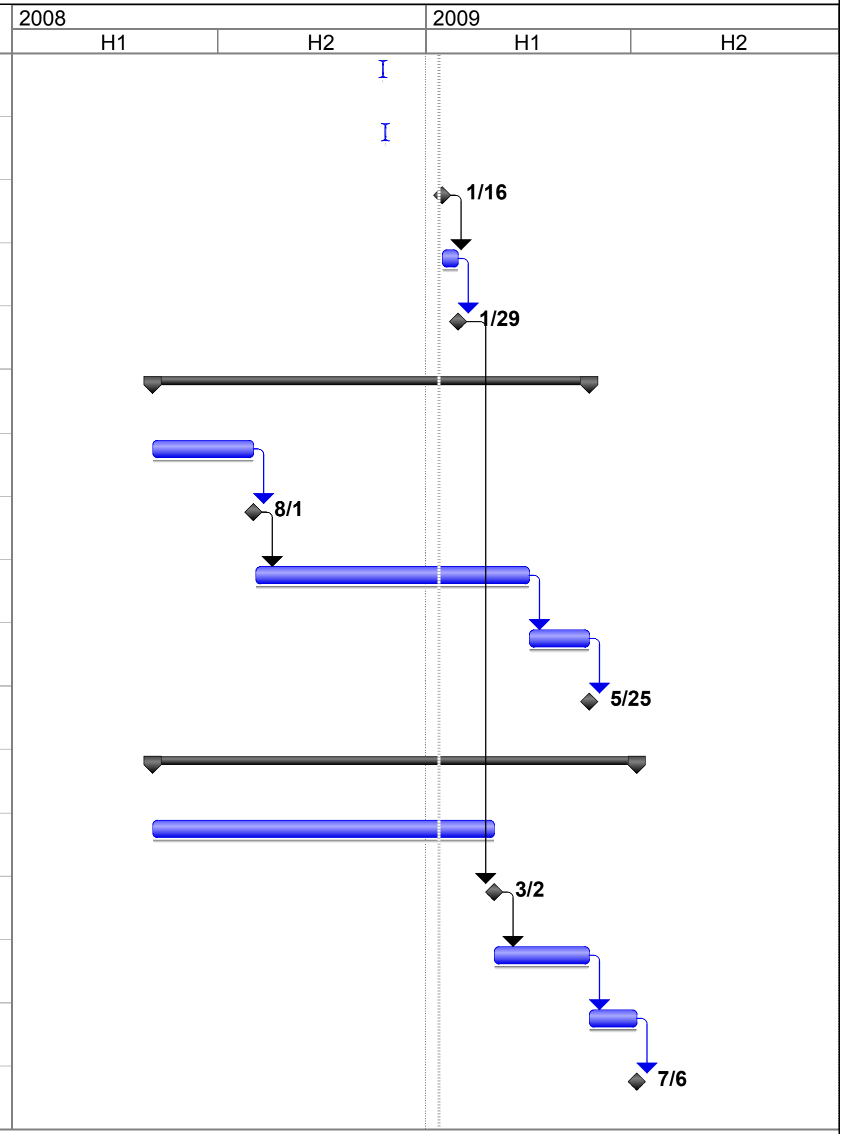


FIGURE 6-1

KERR-McGEE CHEMICAL SUPERFUND SITE SODA SPRINGS, IDAHO ADDENDUM 1 TO THE SOW SCHEDULE

ID	Task Name	Start	Finish
19	Conference Call EPA Comments	Mon 11/24/08	Mon 11/24/08
20	Conference Call EPA Comments	Wed 11/26/08	Wed 11/26/08
21	Submit Second Revision Draft Final Work Plan	Fri 1/16/09	Fri 1/16/09
22	EPA Review of Second Revision Draft Final Work Plan	Fri 1/16/09	Thu 1/29/09
23	EPA Approval of Work Plan	Thu 1/29/09	Thu 1/29/09
24	**Monitor Well Network Evaluation**	**Mon 5/5/08**	**Mon 5/25/09**
25	Evaluate Monitoring Well Network	Mon 5/5/08	Fri 8/1/08
26	Submit Monitor Well Network Evaluation Report	Fri 8/1/08	Fri 8/1/08
27	EPA Review Of Monitor Well Network Evaluation Report	Mon 8/4/08	Thu 4/2/09
28	Revise Monitor Well Network Evaluation Report	Fri 4/3/09	Mon 5/25/09
29	Submit Revised Monitor Well Network Evaluation Report	Mon 5/25/09	Mon 5/25/09
30	**Remedy Evaluation**	**Mon 5/5/08**	**Mon 7/6/09**
31	Evaluate Current Remedy	Mon 5/5/08	Mon 3/2/09
32	Submit Remedy Evaluation Report	Mon 3/2/09	Mon 3/2/09
33	EPA Review Of Remedy Evaluation Report and Comments	Tue 3/3/09	Mon 5/25/09
34	Revise Remedy Evaluation Report	Tue 5/26/09	Mon 7/6/09
35	Submit Revised Remedy Evaluation Report	Mon 7/6/09	Mon 7/6/09



Project: ADDENDUM 1 TO RD/RA SC
Date: Mon 1/12/09

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	

FIGURE 6-1